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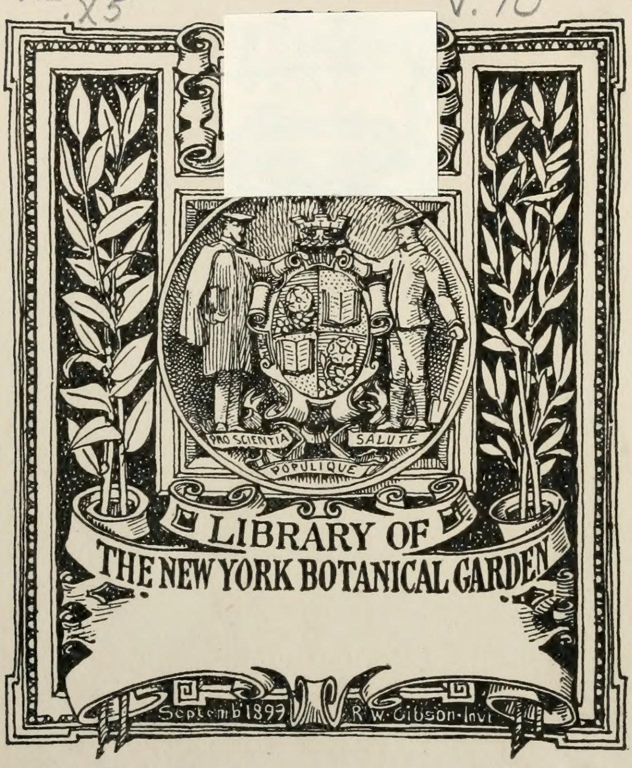
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EXPERIMENT STATION RECORD,

EDITED BY

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AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
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J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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ILLUSTRATIONS.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 1.

Among the many important agencies for agricultural education in this country must be counted the form of university extension work in which home-reading courses are conducted on the Chautauqua plan. The encouragement of agricultural education by this means has been undertaken by several of the agricultural colleges, and with such success as to demonstrate its practicability and value. The interest aroused in systematic reading along definite lines has had a beneficial effect upon the reader, apart from the information gathered, in cultivating the habit of thoughtful reading and in teaching him how to help himself. Not infrequently it has had the effect of arousing in the pupil a desire for college education or at least of helping him to appreciate the benefits of college training. This is a matter of unusual importance in the case of agriculture, as one of the difficulties met with in attracting students to courses in agricultural colleges has been the disparaging of "book farming" by farmers and the failure of the farmer's boy to realize the value to himself of an agricultural course—that there is anything in farming beyond what his father can teach him.

The interest which has been aroused in reading courses where systematic effort has been given to their inauguration has been quite remarkable. The success of the enterprise in the State of New York, where this and other forms of university extension among farmers have been most extensively undertaken, has been especially striking and its results are likely to be very far-reaching. That there is an increasing demand for education by this means is also shown by the year's experience of Cosmopolitan University, which is devoted entirely to instruction through the medium of correspondence. Although in operation less than one year, this institution now has upon its rolls nearly 20,000 students, distributed throughout the United States, Central America, and Canada, who are pursuing courses of reading in a wide range of subjects, under the direction of a faculty located at the university. This faculty numbers fourteen, besides assistants, and their instruction is given entirely through correspondence with the individual pupils. Indeed the instruction is more individual than in ordinary school work, for the individual circumstances and capabilities of the pupils have to be learned and taken into account in assigning and directing the work.

Among its numerous departments the university has one for agriculture, which has met with such success as to be of interest to students of agricultural education. It is especially encouraging as showing the desire for agricultural education by a large body of people who are unable to take up even the short courses offered by so many of the agricultural colleges. This department is presided over by Dr. Lewis McLouth, formerly president of the South Dakota Agricultural College. The field of agricultural science and art has been divided and subdivided under numerous heads, and general and special courses planned to suit the varied demands of pupils. These cover the whole range of the subject, from climate and soil, plant production, animal production, and agricultural industries, to agricultural engineering and business management. In planning these courses and selecting books for the reading, Dr. McLouth has had the counsel of various educators in this field and of specialists. The number of excellent books on various phases of agriculture which have been published during the past few years has been a great aid to this work.

The announcement of the agricultural department states that—

"The need of the average farmer of to day is undoubtedly the power to take a comprehensive view of the agricultural possibilities of his own surroundings. This is obtainable only by study over a field broad enough to enlarge the limited horizon of everyday practical experience. The problem which he must have clearly in mind is, What is the utmost I can do with my present surroundings?

"Thinking brains and trained hands are necessary to success in farming as in all occupations; but the power of good thinking can come only from a thorough analysis and complete understanding of the subject. The science and practice of farming, in its highest form, finds scope for as much knowledge and trained skill as any of the so-called 'learned professions.'"

It is to assist those who are debarred by circumstances from attending an agricultural college but who feel the need of this technical training that the agricultural department of the university is striving. It is gratifying to note that although this department has been organized but a few months nearly 200 persons have taken up the agricultural course, and the interest and enthusiasm displayed by a considerable proportion is most hopeful. These pupils have been drawn from nearly all the walks of life—professional men, retired business men, horticulturists, nurserymen, farmers and breeders, mechanics, clerks in stores, farm laborers, factory operatives, etc. Both sexes and nearly all ages are represented. Each reader is invited to send to the university once a month a written abstract or synopsis of his month's reading for discussion and criticism. At the completion of each course examinations are taken if the reader desires. Questions may be freely asked by pupils at any time concerning difficulties in the reading or in any way bearing upon the subject-matter of study. There are no fees of

any sort. The only expense to the reader is that for books and postage. "The sole conditions of membership are earnestness and reasonable preparation." The entire enterprise is declared by the founder of the university to be a benevolent one, and the expense of conducting it is at present borne by him.

No attempt is made to compete with or take the place of existing means of education. The aim of the university is "to fill a gap in existing means of education, and to bring an opportunity for liberal education, in the true sense of the term, within the reach of all who are unable, because of financial or family reasons, to attend established colleges." Persons whose circumstances and means are such as to enable them to attend the regular schools and colleges are strongly advised to do so.

These various efforts which are being made for popular education in agriculture recognize the fundamental fact that the length and expense of a four years' college course is an insurmountable barrier to the average farmer's son; and the earnestness with which the opportunities offered are being embraced in many localities is a recognition of the rapidly increasing evidence that the farmer needs special training for his occupation. While it is not pretended that the reading course will take the place of the more thorough instruction in agriculture, it will be far better than no course at all. It will open the mind of the pupil to the wonderful progress which is being made in agricultural science and practice. It will enable him to take more thorough advantage of the information furnished through books, bulletins of experiment stations, agricultural papers, farmers' institutes, etc. And it may prove an incentive to keep those boys on the farm who are fitted to get the most in every way out of a farmer's life.

SCANDINAVIAN SEED-CONTROL STATIONS.

F. W. Woll, M. S.,

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The plan of establishing special seed-control stations began to be discussed in the Scandinavian countries at about the same time that it was in Germany, viz. in the early part of 1869, but the latter country led in the realization of the plan by nearly two years. The seed-control station at Tharand, Saxony, was established by F. Nobbe in May, 1869, while that at Copenhagen, Denmark, was opened in February, 1871, by E. Möller-Holst. The Danish seed control celebrated its twenty-fifth anniversary in 1896, on which occasion a special report on Danish seed control, 1871–1896,[1] was prepared for publication by the present director of the station, O. Rostrup, containing an account of the activities of the station since its establishment, and a statement of the present methods of seed analysis followed by the station. Much of the information given in the present article is gleaned from this report and from B. Jönsson's exhaustive paper on the history and present condition of the seed control.[2] The annual reports and other publications of the various stations have furthermore been drawn upon for information concerning the work done by the stations.

The other Scandinavian countries did not organize seed-control stations until several years after the establishment of the Danish station, viz, Sweden in 1876 and Norway in 1884. The two stations of this kind existing in Finland date from 1880 and 1882. (See p. 7.)

The conditions which brought into existence the seed-control stations in the countries named were similar to those found in other countries where such stations were established. Since these conditions are well known to students they need not be considered in detail here. Many kinds of seed sold in the Scandinavian countries during the early stages of the seed control were imported from Germany or surrounding countries, and the frauds described by Nobbe and other early champions of seed control in Germany were also found in the Scandinavian countries, including the use of powdered quartz, white or artificially colored, of any shade desired as an adulterant of clover seed, known to the trade as "Bohemian Mountains;" peat dust for adulterating timothy seed; bleaching of seed; admixtures of killed

[1] Dansk Frökontrol, 1871–1896, O. Rostrup, Copenhagen, 1896. Published by Nordiske Forlag, 84 pp., ill.

[2] K. Landt. Akad. Handl. Tidskr., 33 (1894), pp. 257–286, 321–372 (E. S. R., 6, p. 945).

seed of *Plantago lanceolata* in red clover seed; of charlock and white mustard seed in turnip, rape, or cabbage seed, etc. Besides seed containing worthless adulterations or foul weed seeds, old and inferior seed true to name or seed mixed with that of other cultivated plants of less value was imposed upon an unsuspecting or patient public in much the same way that is possible under present conditions in this country. It was found also that seed which could not be sold in countries where seed control had been established was exported to countries where there was no such control and found a ready market there, until these countries partly as a matter of self-protection founded similar institutions.

The effect of the work of the Danish seed-control station became noticeable almost immediately after the establishment of the station, especially as regards the purity of the seed examined. The quality of the seed on the market, as is shown in the average purity and germination of the seed samples analyzed, has been gradually improved from year to year since the work of the station began, and is now of a very high order.

Selecting a dozen of the more common kinds of seed of legumes and grasses for comparison, we have in illustration of the fact stated the data presented in the following table, which has been compiled from the summary statements published by the station:[1]

Summary of results of Danish seed analyses, 1870–1896.

PURITY OF SEED.

Kind of seed.	1870–71.	1871–72.	1875–76.	1880–81.	1885–86.	1890–91.	1895–96.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Red clover	80.5	88.0	91.7	97.7	97.7	95.9	97.5
White clover	83.6	86.0	91.5	96.3	96.5	95.9	96.7
Alsike clover	82.5	88.0	90.8	96.5	96.5	95.5	97.6
Black medick	91.5	86.0	90.5	97.7	98.7	98.3	98.5
Rye grass	91.0	87.0	90.6	94.4	96.1	95.8	96.3
Timothy	88.0	96.0	94.9	98.0	97.9	98.3	98.5
Meadow foxtail	60.0	72.0	53.0	60.7	74.8	81.4	77.5
Velvet grass	28.5	65.0	39.5	78.0	65.4	69.7	84.1
Fiorin grass	22.0	21.0	55.5	87.2	86.4	94.4	97.9
Rough-stalked meadow grass	42.0	44.0	86.2	80.6	80.8	93.2	94.0
Meadow fescue	57.0	66.0	82.0	90.7	92.7	93.0	95.8
Orchard grass	39.3	60.0	61.3	84.3	79.3	86.2	87.0
Average	63.8	71.6	77.3	88.5	88.6	91.5	93.5

GERMINATION OF SEED.

Kind of seed.	1870–71.	1871–72.	1875–76.	1880–81.	1885–86.	1890–91.	1895–96.
Red clover	91.0	83.0	92.1	91+7[2]	91+8[2]	86+8[2]	90.6+8.3[2]
White clover	83.8	79.0	90.9	84+14	84+15	79+15	82.6+15.7
Alsike clover	81.0	72.0	88.4	88+8	81+17	86+9	90.9+8.3
Black medick	93.5	79.0	81.0	81+9	96.3	81+8	92.5+5.8
Rye grass	84.0	86.0	75.3	80.9	93.1	88.2	93.6
Timothy	89.0	86.0	87.2	83.3	91.0	92.2	95.5
Meadow foxtail	3.0	6.0	45.5	44.4	68.4	68.0	74.9
Velvet grass	27.0	34.0	27.0	49.7	79.5	80.6	88.1
Fiorin grass	42.5	8.0	45.5	90.5	83.0	91.8	94.7
Rough-stalked meadow grass	26.0	12.0	1.0	65.5	77.2	88.3	79.4
Meadow fescue	51.0	41.0	70.5	90.3	94.4	89.1	93.6
Orchard grass	40.4	35.0	71.8	82.6	81.8	83.6	90.9
Average of grass species	45.4	38.5	53.0	73.4	83.6	85.2	88.8

[1] Dansk Frökontrol 1871–1896, p. 10; Annual Report 1895–96, p. 7.

[2] The figures added represent the percentage of hard seed.

HISTORY OF SEED CONTROL IN SCANDINAVIA AND FINLAND.

Denmark.—As already stated, the first seed-control station in Denmark was established in Copenhagen in 1871. This was at first a private enterprise and was conducted for several years at a pecuniary loss, being maintained through the public spiritedness of its founder, E. Möller Holst. The State Agricultural Society in 1881 made an annual appropriation of 1,000 and later of 2,000 crowns ($268 and $536, respectively) for the support of the institution, and in 1883–84 the Government appropriated 2,000 crowns, which was increased in 1886 to 5,000 crowns ($1,340) annually. The State did not, however, assume full control of the station until 1891, when the present incumbent, O. Rostrup, was appointed director. The government of the station is in the hands of a seed-control commission of five members, appointed by the State, which determines the policy and the working rules of the station.

The number of seed samples analyzed by the Danish seed-control station since its establishment aggregates 30,897. The average number of samples analyzed annually has during late years approximated 1,800. The Copenhagen seed-control station is the only public institution of its kind in Denmark.

Sweden.—The first Swedish seed-control station was established in Halmstad in 1876. Later other stations came into existence, as shown in the following statement, furnished through the kindness of Dr. Jönsson, director of the Lund seed-control station.

Swedish seed-control stations, 1896.

County (*län*).	Location.	Director.	Year of establishment.	Number of analyses made in 1895.
Halland	Halmstad	E. Lyttkens	1876	246
Kalmar	Kalmar	A. Atterberg	1877	603
Skaraborg	Skara	O. Nylander	1877	32
Westmanland	Westeras	J. O. Bergstrand	1877	150
Stockholm	Stockholm	O. Stjernquist	1878	1,001
Oestergötland	Linköping	C. A. Blum	1878	401
Kristianstad	Kristianstad	L. J. Wahlstedt	1879	345
Göteborg and Bohuslän	Göteborg	J. E. Alén	1879	261
Oerebro	Oerebro	J. Widén	1880	831
Malmöhus	Lund	B. Jönsson	1880	1,255
Westerbotten	Umea	C. N. Pahl	1880	39
Jemtland	Ope	J. F. Broman	1881	137
Upsala	Upsala	T. von Post	1882	345
Jönköping	Jönköping	R. Tolf	1882	365
Getleborg	Getle	A. Westman	1883	189
Vesternorrland	Hernösand	C. G. Strokirk	1883	434
Södra Eltsborg	Boras	A. W. Essén	1885	210
Norrbotten	Lulea	P. Hellström	1889	58
Gotland	Hemse	T. A. Satervall	1889	39
Värmland	Molkom	J. A. Andersson	1891	215

A number of the twenty seed-control stations in operation at the present time are combined with "chemical stations" under the same director. They are supported partly by State and county aid, partly by the income from analysis fees. The State appropriation varies from 350 to 850 crowns ($93.80 to $227.80) annually to the various stations, or 10,000 ($2,680) in the aggregate. In a few cases, e. g., Lund, the

director is dependent upon the analysis fees as payment for his services. The stations presenting a full report of their receipts and expenditures during 1894–95 received from 57.8 crowns (Luleå) to 2,071.58 crowns (Stockholm) in analysis fees (equivalent to $15.49 to $555.28, respectively). The stations report to the State Agricultural Department (*Kongl. Landtbruksstyrelsen*) and work under the regulations prescribed by the Department.

The total number of seed samples analyzed annually by the stations has of late years exceeded 6,000. In 1894, 6,581 samples were analyzed, and in 1895, 7,078 samples. Of the latter number, 2,466 samples were analyzed for farmers, 3,770 for seedsmen, and 842 samples were bought in the open market by the stations themselves; 5,153 complete and 1,925 partial analyses were made. In addition to this analytical work a majority of the stations furnish to seedsmen tags guaranteeing the quality of seed in bags from which samples are drawn and analyzed.

Finland.—Two seed-control stations are in operation in Finland, one in Helsingfors and one in Aabo, established in 1880 and 1882, respectively. Both stations are operated in connection with a chemical station, and are supported partly by the Government and partly by annual grants from the city in which each is located. The number of analyses (including chemical analyses) made during 1895 at the Helsingfors station is given as 2,435, 412 being seed analyses. At Aabo 1,006 analyses were made in 1895, of which number 225 were seed samples.

Norway.—Official seed control was organized in Norway in the beginning of 1884, when the seed-control station at Haug was established by the Agricultural Society of Kristians *amt* (county). Later (in 1886) control stations were established in Christiania, Hamar, and Trondhjem, and the station at Haug was discontinued. The Christiania station is largely supported by an annual appropriation from the patriotic Society for Norway's Weal (*Selskab for Norges Vel*), while the other stations have small subsidies from the counties in which they are located and are primarily dependent for their support on the analysis fees received.

The number of analyses made at the Christiania control station during the decade 1886–1897 aggregates 2,029, viz, 1,724 complete and 305 partial analyses. About 200 samples are analyzed annually.

METHODS OF ANALYSIS.

The methods of analysis in vogue in the seed-control stations of the Scandinavian countries were worked out by representatives of the three countries, constituting the Scandinavian seed-control committee, in meetings held in Copenhagen in the latter part of 1890. The rules proposed by this committee were subsequently approved by the respective government authorities, with but insignificant changes. The methods and regulations concerning the seed control have therefore during late years been essentially the same in all the Scandinavian countries and in Finland as well. A summary of the methods of analysis and the regulations governing the seed control in these countries is given below.

A complete seed analysis includes determinations of (1) genuineness, (2) purity, (3) weight, and (4) germination. If partial examinations are desired covering one or more points, the fact that such examinations alone have been made, and that the certificate does not give any guaranty for the general quality of the seed, is to be expressly stated.

(1) *Genuineness.*—The genuineness of the seed is determined by the aid of the standard seed collection of the control station or the seed manuals. Both popular and Latin names of the seed examined are given in the certificate, and, so far as practicable, also the variety and cultural form.

(2) *Purity.*—The purity of the seed is determined in average weighed samples by hand picking or screening. As the lower limit for the size of the sample used for this purpose the average dry weight of 1,000 seed multiplied by 10 is generally taken. An exception is made in case of seed a hectoliter of which weighs more than 25 kg. For such seed the lower limit is found by multiplying by 5. The sample must never weigh less than 2 gm. and for large seeds like beans, etc., at least 300 gm. is required.

In purity determinations the seed is separated into (1) pure seed and (2) impurities. The latter include (*a*) offal (fragments of plants and seeds, dirt, sand, stones, etc.), (*b*) foreign culture seed, and (*c*) weed seed. The quantities of these different components are determined by weighing, and are given on the certificate issued, calculated to per cent of the seed. The weed seeds are separated into harmless and noxious seed. Under the latter are included the following 14 kinds in addition to rust spores and sclerotia: *Agrostemma githago*, *Bromus secalinus*, *Bunias orientalis*, *Centaurea cyanus*, *Chrysanthemum segetum*, *Cirsium arvense*, *Cuscuta trifolii*, *Matricaria inodora*, *Ranunculus repens*, *Raphanus raphanistrum*, *Rhinanthus crista galli*, *Sinapis arvensis*, *Brassica campestris*, and *Sonchus arvensis*.

(3) *Weight.*—For the determination of the dry weight of 1,000 seeds three lots of 200 seeds of the thoroughly mixed sample of pure seed are counted and weighed. The fresh weight of 1,000 seeds is found by multiplying by 5. If the parallel determinations differ more than 5 per cent for small seed (i. e., average dry weight per 1,000 seeds below 5 gm.) and 10 per cent for large seed (i. e., average dry weight per 1,000 seeds over 5 gm.) the determinations are repeated. A dry-matter determination is then made of the sample of pure seed by grinding 10 to 20 gm. of large seed in a small mill and weighing out 2.5 gm. of the ground seed. In case of small seed 1 gm. of whole seed is weighed out. These quantities are dried for 4 hours in a steam oven. The percentage of dry matter thus found, multiplied by the fresh weight of 1,000 seeds, gives the dry weight of 1,000 seeds, which is reported with 3 decimals in the analysis certificate.

The determination of the hectoliter weight of cereals and legumes is obligatory in case of complete analysis, the result being expressed with 3 decimals.

(4) *Germination.*—The three samples of 200 seeds each used for the determination of the fresh weight are taken for this determination. If the parallel results calculated in percentage of pure seed do not come within 6 per cent a new germination test is made. For this determination such methods, apparatus, temperature, etc., are adopted as will give the highest and most uniform results in each particular case. The seed may be soaked in water for 10 minutes prior to being placed in the germination apparatus. Of late years soaking has, however, generally been abandoned, as it has been found of no advantage in hastening the germination.

The germination test is discontinued at the end of the number of days given below, in case of the various kinds of seed:

	Days.
Cabbage, radish, mustard	8
Spergula, barley, rye, wheat, timothy, flax, kidney vetch, birds' foot trefoil, lupine, medick, bean, pea, clover, bean vetch (*Vicia faba*), buckwheat	10
Common oats, Tartarian oats, lentil, lathyrus, Orobus, vetches (exclusive of *Vicia faba*)	12
Fiorin grass, foxtail, tall oat grass, yellow oat grass, reed canary grass, Brachypodium, brome grass (*Bromus arvensis* and *B. mollis*), meadow fescue, reed meadow grass, rye grass, Schedonorus, esparcet, serradella, caraway, carrot, parsnip, etc	15
Aira, sweet vernal grass, quaking grass, crested dog's tail, orchard grass, lyme grass, hard fescue, giant fescue, *Festuca heterophylla*, sheep's fescue, red fescue, *Festuca sylvatica*, velvet grass, psamma grass	20
Meadow grasses (*Poa* spp.), seed of most trees	25

Besides the germination proper, the so-called germinative energy, i. e., the number of seeds germinating in certain briefer periods of time, is given. These differ with different seeds, and are as follows:

	Days.
Lucern, yellow mustard, turnips	2
Red, white, and alsike clover, kidney vetch, ruta-baga	3
Black medick, spurry, timothy, brome grass (*Bromus arvensis* and *B. mollis*)	4
Common and Italian rye grass, fiorin, tall oat grass, meadow fescue	5
Carrot, fodder beet, meadow foxtail, velvet grass, Kentucky blue grass	6
Hard fescue, orchard grass	7
Meadow grass (*Poa* spp.)	8

In regard to the germinative energy of seed of different age Möller-Holst found that Scandinavian seeds germinate better and more rapidly in the spring than during the preceding fall, but as a rule the germinative energy continues to increase during the following six to twelve months. As long as this is the case the seed can not properly be called old, even if they have lost their brightness and color, which is apt to happen, particularly with white-clover seed. It was found that the germinative energy increased during five to fifteen months after the first germination test was made for red clover, white clover, alfalfa, caraway, barley, orchard grass, and common rye grass.

(5) *Hard seed.*—The hard seed of legumes and nongerminated seed of very slowly germinating tree seed, which prove viable on being cut open, are given in a special column as "hard." Other seeds which have not germinated are given as "dead." The germination of beet seed is calculated in percentage of viable bolls.

The proportion of hard seeds in seed of leguminous plants has been determined at the Danish seed-control station since the summer of 1874. Experiments in the open field having shown that about half of the hard seeds germinated during the summer, the percentage of germination is increased by one-half the percentage of hard seeds. Since 1887 the percentages of germinated and hard seeds have been given separately in the analysis certificates, and according to common usage in Denmark the viability of a sample of leguminous seeds has come to mean the sum of the germinated and hard seeds. In the other Scandinavian countries and in Finland only one-third of the hard seeds are as a rule considered viable.

A greater proportion of hard seeds is found soon after harvest than later on, the proportion decreasing somewhat in the course of the winter. The samples of red, white, and alsike clover analyzed at the Danish station during the year 1886–87 contained on an average the following percentages of hard seed: November, 16 per cent; December, 12 per cent; January, 10 per cent; February, 9 per cent; March, 9 per cent; April, 9 per cent; and May, 9 per cent.

The germinative ability of hard seeds increases with age, but the method of keeping the seed has a marked influence, a dry, warm atmosphere being favorable to the preservation of their hardness.

Where the proportion of hard seeds approaches 20 to 30 per cent or exceeds these figures, as is often the case with white and alsike clover, the matter of hard seeds becomes one of great importance. Under ordinary conditions and with other leguminous seeds the depreciation from this cause is considerable.

Efforts have been made to prepare hard seed so as to secure perfect germination, but they have not been altogether successful until lately. The seed-coat crusher (*fröpräparator*) constructed by N. Hj. Nilsson, director of the Svalöf seed station in Sweden, may be said to have practically solved the problem. The seed crusher consists of an emery cylinder, which is rotated at the rate of 3,200 revolutions per minute. The seed passing through the machine is thrown against the cylinder and its seed coat scratched so as to readily permit the entrance of water to the germ of the seed.

The earlier form of the machine worked in a satisfactory manner, but its capacity was too small, viz, only one to one and one-half bags of seed (100 to 150 kg.) per day. The machine as now perfected and manufactured has a capacity of 100 to 200 kg. per hour, according to the kind of seed treated. The price of the seed machine, which is patented, is 300 crowns ($81). The treatment by the process has been

found to have no injurious effect on the seed. The machine has been generally adopted by Scandinavian seedsmen.

Germination tests of seeds before and after being run through the "Nilsson" or "Svalöf" seed-coat crusher show the great improvement resulting from this treatment. The Copenhagen station has published the following results: Red clover containing 25 per cent of hard seed—germination before treatment (in three days), 61 per cent; after treatment (in three days), 96 per cent. White-clover seed containing 34 per cent of hard seed—germination before treatment (in five days), 62 per cent; after treatment (in three days), 99 per cent. Alsike clover seed containing 66 per cent of hard seed—germination before treatment (in four days), 27 per cent; after treatment (in three days), 98 per cent.

LATITUDE ALLOWED IN SEED ANALYSIS BY THE DANISH SEED-CONTROL STATION.

The latitude allowed in seed analysis for purity is 2 per cent; for germination of pure seed, 3 per cent in case of over 95 per cent germination, 4 per cent in case of 90 to 95 per cent germination, and 5 per cent below 90 per cent germination; for germination of seed purchased (pure viable seed), 5 per cent; for grain weight, 6 per cent for leguminous seed and 10 per cent for grass seed; for weed seed, 0.3 per cent (see below).

The amount of discount per pound to be allowed for deficiency in purity and germination is calculated as follows:

$$\text{Discount for impurity} = \frac{\text{Deficiency per cent} \times \text{price per pound}}{\text{Guaranteed purity.}}$$

$$\text{Discount for deficient germination} = \frac{\text{Deficiency per cent} \times \text{price per pound}}{\text{Guaranteed germination.}}$$

Hard seeds.—If certain percentages of hard and of viable seeds are guaranteed the hard seeds are calculated as equal to one-third the value of the viable seeds, unless another relation is agreed upon at the time of the sale.

Weight.—For each deficient per cent a discount of one-half of 1 per cent of the price of the seed is given.

Weed seeds.—For the deficiency, calculated in percentage of the seed, 15 per cent of the cost of the seed is deducted for each per cent of weed seeds unless these are harmless. In such case the discount is given for a possible excess of impurities. If the seed is guaranteed free from noxious weeds beyond a certain maximum, a content of 100 dodder seeds and 200 other foul weed seeds per kilogram beyond this maximum is allowed. In case of a greater content of weed seeds a discount of 2 per cent of the cost of the seed per kilogram is given for each 100 and 200 weed seeds, respectively, contained therein beyond the maximum quantity allowed, the greatest discount allowed being 25 per cent of the cost of the seed.

GERMINATION APPARATUS.

The Noble clay disks are used to some extent in a number of Scandinavian seed-control stations, but where a large number of analyses are made either the Jacobsen or the Strokirk germination apparatus is used. The former (fig. 1), constructed by C. P. Jacobsen, of Copenhagen, consists of a large, square, metal tank, in which are placed narrow glass plates (*a*). On these, round felt pieces are laid, which are connected with the water in the tank by means of small wicks. A thick, loosely woven mat is placed on the felt, and on this again a piece of filter paper, upon which the seeds to be tested are spread. A small glass bell supplied with a narrow opening at the top, to provide for circulation of air, is placed over the disks. The disks of felt and the woven mat also have holes in the middle to facilitate circulation. A gas burner (*c*) heats the water in the tank, and to distribute the heat more evenly a metal plate (*b*) rests loosely on small pillars, which support it a couple of inches above the bottom.

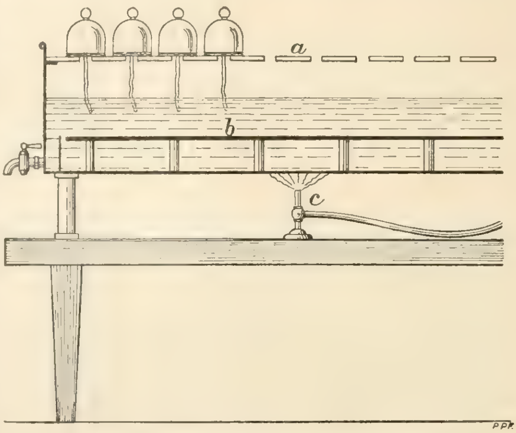

FIG. 1.—Jacobsen's seed-testing apparatus.

This apparatus is easily regulated as to moisture and temperature, is easily cleaned and examined, takes comparatively little room, and gives very satisfactory and comparable results. The two pieces of apparatus of this kind in use in the Danish seed-control station in 1896 had a capacity of 253 and 119 germination tests, respectively, at a time. The tank, disks, glass plates, etc., were cleaned with boiling water once every week, and the filter paper renewed every four days.

The temperature of the bath ranges from 15 to 26° C., the temperature during the night being 16 to 17° C. Experiments made with a view of finding a more favorable temperature have always given negative results, as shown in the following series of experiments made by the Danish seed control:

Effect of constant and variable temperatures on germination.

	Number of samples.	Viability at—	
		18–25° C.	Constant at 25° C.
Orchard grass	30	87.3	86.3
Common rye grass	14	83.5	81.9
Italian rye grass	10	82.5	82.1

These results corroborate those obtained by Stebler, who recommends on the average 19°, not higher than 26°, but where it is possible not below 15°.

TAGS FOR SEED IN BAGS.

A number of Swedish and Finnish control stations offer seedsmen an opportunity to guarantee the quality of their goods by furnishing tags for seed in bags which upon analysis has been found to come up to a certain standard. If a quantity of seed analyzed does not come up to the standard it can not be sold with station tags. The standards refer to the percentages of pure germinated seed in the goods, and are as follows:

Minimum pure germinated seed for goods supplied with control tags.

	Per cent.
(1) Cereals (straw and grain crops)	90
(2) Fodder plants:	
Red clover	80
White clover, alsike clover, medick, kidney vetch	75
Brome grass (*Bromus arvensis* and *B. mollis*), meadow fescue, timothy, rye grass (*Lolium italicum* and *L. pratense*)	80
Orchard grass, tall oat grass	65
Hard fescue, red fescue, sheep's fescue	60
Crested dog's tail, fiorin grass	55
Reed canary grass, *Aira cæspitosa, A. flexuosa,* yellow oat grass, sweet vernal grass, meadow foxtail	40
Velvet grass	35
Meadow grass (*Poa* spp.)	30
(3) Various crops:	
Rape (*Brassica* spp.)	95
Spurry (*Spergula sativa* and *S. maxima*), mustard	90
(4) Root crops:	
Mangel-wurzels, ruta-bagas	95
Beets	85
Carrots	55
(5) Tree seed: Conifers	70

The tags furnished give the main results of the analyses as follows: Name of seed, dry weight of 1,000 seeds, percentage of pure viable seed, hard seed, dead seed, chaff, dirt, etc., seed of other cultivated plants, weed seed, number of noxious weed seed per kilogram of sample, name of station, date, etc.

The Finnish stations, in addition to information similar to that given above (in Swedish and Finnish), give on the reverse of the tag the number of each of the following noxious weed seed found in 1 kg. of the seed, the names of the weed seeds being given in Latin, Swedish, and Finnish: *Agrostemma githago*, *Agrostis spica venti*, *Rumex crispus*, *R. domestica*, *Thlaspi arvense*, *Barbarea vulgaris*, *Cuscuta trifolii*, *Anthemis tinctoria*, *Matricaria inodora*, *Cirsium arvensis*, *Centaurea cyanus*, *Chrysanthemum leucanthemum*, *Bromus secalinus*, *Raphanus raphanistrum*, *Brassica campestris*, *Sinapis arvensis*, *Bunias orientalis*, *Sonchus arvensis*, and *Claviceps purpurea*.

The total amount of seed examined and supplied with tags during 1895 by the thirteen Swedish seed-control stations called upon to do this work was in the aggregate 1,599,141 kg., or over 14,000 bags. The two Finnish stations supplied tags for 6,529 bags of seed during 1895.

COST OF SEED ANALYSES.

The tariff of the Danish seed control for analyses of seed samples is as follows:

Tariff of the Danish seed control for seed analyses.

Determination of—	
Genuineness	1.0 crown = $0.27
Hectoliter weight	1.5 do = .40
Absolute weight	1.5 do = .40
Purity of large seeds	2.0 do = .54
Purity of small seeds	3.0 do = .80
Number of Cuscuta seeds per kilogram	3.0 do = .80
Pure viable seed, large seeds	4.0 do = 1.07
Pure viable seed, small seeds	5.0 do = 1.34
Complete analysis, large seeds	5.0 do = 1.34
Complete analysis, small seeds	7.0 do = 1.88

Seedsmen who offer farmers the privilege of free examination of seed purchased of them pay 3 crowns (80 cts.) for such complete analysis of large seeds and 4 crowns ($1.07) for the other kinds of seed.

The tariff in force at Norwegian seed-control stations is lower than that of the Danish station, viz, complete analysis of seed offered for sale, 4 crowns ($1.07); of that grown by the sender, 3 crowns (80 cts.); of that purchased for own use, 3.60 crowns (96 cts.).

Discounts are given to all parties whose annual analysis fees reach 50 crowns ($13.40) as follows: For 50 crowns, 20 per cent; 55 crowns, 21 per cent; 65 crowns, 22 per cent; 80 crowns, 23 per cent; 100 crowns, 24 per cent; 125 crowns, 25 per cent; 155 crowns, 26 per cent; 190 crowns, 27 per cent.

Swedish seedsmen pay 3 crowns (80 cts.) for a complete seed analysis at their seed-control stations, 5 crowns ($1.34) for determination of the different kinds of foreign seeds, and 25 öre (6.7 cts.) per tag furnished. Customers within the particular county in which the station is located and which contributes to the support of the station, pay only 1 crown (27 cts.) for a complete seed analysis, including determinations of genuineness, purity, and germination; and 5 crowns ($1.34) for determination of different kinds of foreign seeds.

The tariff at the Finnish control stations is somewhat lower, viz, 3 Finnish marks (58 cts.) for a complete analysis of large seeds, 4 Finnish marks (77 cts.) for small seeds, and 20 penni (4 cts.) per tag furnished.

PERSONNEL AND EQUIPMENT.

The majority of the Scandinavian seed-control stations have one officer, the director of the station, or a director and assistant. A few

stations employ additional temporary help during the rush of the season. The largest Scandinavian seed station, the Danish seed control, is officered as follows: 1 director, 1 first assistant (bookkeeping and correspondence), 1 gardener, and 9 assistants; the latter and the first assistant are women.

The larger stations are supplied with Jacobsen's germination apparatus; others use that of Strokirk or Nobbe's plates. The Nobbe thermostat for seed examinations or larger thermostats are often found. Other apparatus met with are Stjernquist seed examiner, Stebler diaphanoscope, Sommer and Runge liter weight, Nobbe seed duster ("spreufege"), Svalöf seed-coat crusher, "seed horn," Maercker seed marker, analytical balance, microscopes, pocket lenses, sieves, etc.

As important as any of the preceding apparatus are the standard collections of pure seeds of cultivated plants and of the different weeds. These collections are invaluable for identifying foreign seeds in samples received for examination. Mention should also be made of the reference library with which the stations (or the officers privately) are supplied, consisting, first of all, of manuals on seeds and seed testing (Nobbe, Harz, Settegast), and of works on botany, microscopy, technology, etc.

Whenever tests are reported by any seed-control station, blanks are furnished stating the results of the examinations. These are generally reported on a printed form in which the percentages, etc., are tabulated so as to show the value of the seed at a glance.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

New method for water analysis—Application of oleic acid as an indicator in the quantitative determination of mineral matter, E D'HUART (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 289–293*).—In the method proposed oleic acid or olein and soda solution, used separately, are substituted for the soap solution ordinarily employed in testing the hardness of water. The method is as follows: To 50 cc. of water add a few drops of pure olein, and then slowly run in decinormal soda solution until a lather appears on shaking, which rapidly disappears on standing.

To another sample of 100 cc. of water add a few drops of hydrochloric acid and boil until the carbon dioxid is completely expelled. Cool, neutralize the acid carefully, evaporate to 50 cc., and test as above directed. The result thus obtained, subtracted from the first determination, gives the amount of soda equivalent to carbon dioxid in the water.

Boil a third sample of 50 cc. of water until the free carbon dioxid and that of the bicarbonates is driven off. Cool, filter, make up the volume to 50 cc. with distilled water, and test as before. This furnishes data for calculating the amount of carbon dioxid in the form of bicarbonate.

To a fourth sample of 100 cc. of water add sufficient ammonium oxylate to completely precipitate the calcium salts. Boil for half an hour, filter, cool, evaporate to 50 cc., and test as before to determine the equivalent in caustic soda of the magnesia present in the water. In comparative tests results obtained by this method agreed closely with those obtained by gravimetric methods.

Percentage of phosphoric acid in potable waters, C. LEPIERRE (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 267–272, dgms. 2*).—This is a study of the method proposed by Villiers and Borg.[1] As a result of the study, the following modification of the method is proposed: Evaporate 1 liter of water to dryness in a porcelain, or better in a platinum dish, with the addition of dilute nitric acid to separate the silica. Take up in nitric acid and evaporate again to dryness to remove the last traces of silica. Filter and wash until the filtrate amounts to 50 cc. and add 2 cc. of molybdic solution, prepared by dissolving 150 gm. of

[1] Bul. Soc. Chim. Paris, 9 (1893), p. 486 (E. S. R., 5, p. 519).

ammonium molybdate in 1 liter of water. The phosphoric acid is determined by comparing the coloration thus produced with that of standard solutions of phosphate to which an equal quantity of molybdic solution has been added.

Note on the estimation of citrate-soluble phosphoric acid in Thomas slag, M. PASSON (*Ztschr. Angew. Chem.*, *1897*, *No. 23*, *pp. 746–749*).—Instead of the solution used by Wagner, the author recommends a solution containing 140 gm. crystallized citric acid and 30 gm. tripotassium citrate in 1 liter. This solution gives results identical with the Wagner solution and is much easier to make. The tripotassium citrate is prepared by adding to a solution of citric acid rather more than enough potassium hydrate to neutralize the acid, evaporating the solution on a water bath until it begins to crystallize, allowing it to cool, and then stirring until a complete crystallization has taken place. The mother liquor is then drawn off, the salt washed with as little water as possible until the alkaline reaction disappears, then several times with alcohol and ether, and finally dried between folds of filter paper.—J. B. LINDSEY.

A new method for the estimation of starch in grains, L. LINDET (*Ztschr. Angew. Chem.*, *1898*, *No. 7*, *p. 166*).—Ten grams of the ground grain is treated for 24 hours at 40 to 50° C. with a solution containing 2 per cent of pepsin and 1.5 per cent of hydrochloric acid. The solution is then brought into a small sack made of fine bolting cloth (80 to 100 mesh) and suspended in water until the starch appears to be entirely removed. The water should be changed frequently during the washing. The combined waters are filtered through a tared filter to collect the starch. The paper should be dried, first at 50° C. and later at 105° C. to constant weight.—J. B. LINDSEY.

On the practical application of the refractometer in butter examination, A. J. SWAVING (*Landw. Vers. Stat.*, *49* (*1897*), *No. 4–5*, *pp. 341–347*).—The author states that shipments of pure butter from Holland and Friesland to England have repeatedly been held to be suspicious on account of being below the limit for volatile fatty acids adopted by English chemists. This difficulty, it is believed, could be avoided by the use of the refractometer, which is also a great saving of time.

The results are tabulated for 624 samples of butter examined with the refractometer and for volatile fatty acids. Of these, 353, or 56 per cent, showed a refractive index of 52.5° or less; and 127, or 20 per cent, showed a refractive index of 52.5 to 54°. These 480 samples were proved to be pure, natural butter. The remaining 144 samples, or 24 per cent, showed a higher refractive index (than 54°) and were in part identified as adulterated.

In the case of butter containing admixtures of other fats it is considered necessary to make an examination with the polarizing microscope, in addition to determinations of the volatile fatty acids and the

refractive index, to detect crystals of foreign fats. The refractive index and volatile fatty acids are given for a number of vegetable and animal fats, and the application of these data in the examination of mixed butters is described.

The examination of filled cheese, A. DEVARDA (*Ztschr. Analyt. Chem., 36 (1897), No. 12, pp. 751–766, fig. 1*).—To obtain large quantities of cheese fat for investigation the following method is recommended: From 50 to 100 gm. of finely cut cheese is placed in a flask with 50 to 80 cc. water, 100 to 150 cc. ether, and 2 drops of phenolphthalein solution. The whole is vigorously shaken and dilute caustic potash added until the reaction is distinctly alkaline, when the shaking is repeated. After standing a short time the layer of fat solution may be drawn off, filtered, and dried at 100° C.

If the fat has been thus extracted, the Reichert-Meissl method is believed sufficient to indicate the presence of foreign fat.

Water is determined in the cheese by drying the finely cut sample 24 to 36 hours in vacuo over sulphuric acid at room temperature, completing the operation by heating to constant weight at 100° C., 2 to 6 hours being generally sufficient.

The cheese, after drying by the above-described method, is finely ground and extracted with water-free ether. The crude fat thus obtained is dried 2 hours at 100° C.—L. H. MERRILL.

A new drying oven with a constant temperature, M. C. SCHUYTEN (*Chem. Ztg., 21 (1897), No. 100, p. 1049, fig. 1*).—This is on the principle of the water bath with a constant level. A double-walled drying oven is connected with an automatic constant-level reservoir of pure water by means of a connecting tube, which is provided with two stopcocks. One of these cocks is intended to establish connection between the oven and reservoir, and the other to allow egress of the liquid from the oven. Sodium nitrate is dissolved in the water to elevate the boiling point, the requisite amount being determined by trial. If the temperature of boiling is too low, more nitrate is added; if too high, some of the solution is drawn off and its place supplied with fresh water from the reservoir. When the desired point has been once reached and connection with the fresh-water reservoir established, the temperature remains constant. The temperature of boiling of the solution is constant so long as its density is constant, and this remains so indefinitely, inasmuch as the water lost by evaporation is renewed automatically from the fresh-water reservoir.—J. T. ANDERSON.

Second International Congress of Applied Chemistry, 1896 (*Deuxième congrès international chimie appliquée, 1896. Paris: Association des Chimistes de Sucrerie et Distillerie, 1897, 5 vols.*).—This contains a report of the proceedings of the congress and the papers presented, edited by F. Dupont. Volume I (pp. 721, ill.) contains reports of section 1 on sugar and section 2 on alcohol and fermented products; Volume II (pp. 544), of section 3 on agricultural industries, section 4 on agricultural chemistry, and section 5 on official analysis and apparatus of precision; Volume III (pp. 499, ill.), of section 6 on chemical industries, section 7 on photography, and sec-

tion 8 on metallurgy, mines, and explosives; Volume IV (pp. 659, ill.), of section 9 on chemistry applied to medicine, pharmacy, hygiene, and food, section 10 on electro chemistry and electro metallurgy, and section 11 on purification, etc., of water from manufactories. Volume V (pp. 360) contains a list of members and names of committees, with reports of excursions, etc.

Quantitative analysis of phosphates, R. M. CAVEN (*Jour. Soc. Chem. Ind., 16 (1897), pp. 208, 209; abs. in Jour. Chem. Soc. [London], 74 (1898), No. 425, II, p. 187*).

Kjeldahl's process, J. O. SULLIVAN (*Jour. Soc. Chem. Ind., 16 (1897), pp. 111, 112; abs. in Jour. Chem. Soc. [London], 74 (1898), No. 425, II, p. 186*).—The author used in the analysis of malt extract and ale a mixture of 1 part strong sulphuric acid and 2 parts of Nordhausen acid, adding 0.5 gm. of mercuric oxid at the beginning and completing the oxidation with potassium permanganate.

The use of mercuric chlorid for preserving samples of juice for analysis, H. COURTONNE (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 251, 252*).

Simple method for analyzing organic materials (butters, oils, waxes, hydrocarbons, essences, etc.), by the determination of the critical temperature of solution, L. CRISMER (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 273–288, dgms. 2*).

International agreeement in agricultural analysis, H. W. WILEY (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 237–240*).

On the analysis of beets, F. SACHS (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 286–290, figs. 2*).

A method of analysis applicable to salt and crude potashes, F. JEAN (*2. Congrès Internat. Chim. Appl., 1896, III, pp. 20, 21*).—Detailed directions are given for the analysis of mixtures of caustic alkalies, and alkaline chlorids, carbonates, and sulphates.

Commercial methods of analysis of flour and meal, M. ARPIN (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 58–63*).

Note on the determination of metaphosphoric and pyrophosphoric acids in superphosphates, PIRON and NAY DE MÉZENCE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 174–177*).—The method proposed for the determination of metaphosphoric and pyrophosphoric acids is as follows: Digest 2.5 gm. of the superphosphate in a 250 cc. flask with 100 cc. of ammonium citrate for 12 hours. Make up the volume to 250 cc. with water and filter. To 100 cc. of the filtrate add a slight excess of nitric acid (about 15 cc.). Heat at a temperature near the boiling point for 1 hour, cool, and precipitate phosphoric acid in the usual way. The difference between the amount of phosphoric acid thus determined and that found by precipitation in 100 cc. of the filtrate in the usual manner, without treatment with nitric acid, gives the amount of metaphosphoric acid contained in the superphosphate.

The agricultural value of Thomas slag, CLUSS (*Ztschr. Angew. Chem., 1898, No. 11, p. 248*).—The author describes a modification of the Wagner method for ascertaining the agricultural value of the phosphoric acid in Thomas slag. To 100 cc. of the usual citrate acid solution containing the slag is added 20 cc. of concentrated nitric acid, and the solution boiled in an Erlenmeyer flask until the volume is reduced to about 20 cc. Twenty-five cubic centimeters of concentrated sulphuric acid is then added, and the solution boiled (about 10 minutes) until the silica is deposited. The solution is then made to 250 cc., and the phosphoric acid estimated in 100 cc. of the filtrate.—J. B. LINDSEY.

Determination of nitrates by titration, J. COTRAIT (*2. Congrès Internat. Chim. Appl., 1896, II, p. 183*).—The method employed is as follows: Place in a test tube 10 cc. of pure sulphuric acid and 10 cc. of the solution to be tested, covering the surface with a few drops of naphtha to exclude the air. Add a solution of ferrous sulphate until the brown coloration of the solution just becomes permanent. The ferrous sulphate solutions are made of different strengths, that of the more concentrated solutions being such that one-tenth of a cubic centimeter corresponds to 10 mg. of nitrate, while in case of the weaker solution it corresponds to 2 mg. of nitrate. From the amount of solution used the percentage of nitrate present is calculated.

Estimation of nitrates and nitrites as nitric oxid, J. COTRAIT (*Ztschr. Angew. Chem., [illegible], No. 11, p. [illegible]*).—An abstract of the preceding paper.

Determination of nitric acid by electrolysis, K. ULSCH (*Ztschr. Elektrochem., 3 (189[illegible]), pp. [illegible]; abs. in Jour. Chem. Soc. [London], 74 (189[illegible]), No. [illegible], II, p. [illegible]*).—The nitrate dissolved in seminormal sulphuric acid is reduced to ammonia, using a copper cathode and platinum anode. The method described is applicable only to pure nitrates, since chlorids and other substances naturally occurring in nitrates interfere with its accuracy.

The direct determination of potassium carbonate in salt, A. AULARD (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 454–463*).—This is Heyer's method completed and modified in some details.

The determination of animal and vegetable fats, T. TAYLOR (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 337–340, pls. 9*).

Study on the determination of tannins, E. AGLOT (*2. Congrès Internat. Chim. Appl., 18[illegible], III, pp. 1–11*).—See below.

Studies on the estimation of tannin, E. AGLOT (*Ztschr. Angew. Chem., [illegible], No. [illegible], pp. [illegible]*).—The author reviews the various methods employed for the estimation of tannin, calls attention to their weak points, and offers suggestions, based upon his work, for their improvement.—J. B. LINDSEY.

Determination of copper in vegetable substances, B. H. PAUL and A. J. COWNLEY (*Rev. Internat. Falsif., 11 (18[illegible]), No. 1, p. 21; abs. in Ztschr. Angew. Chem., [illegible], No. 14, p. [illegible]*).

Detection of copper in canned peas, BODMER and MOOR (*Rev. Internat. Falsif., 11 (18[illegible]), No. 1, p. [illegible]; abs. in Ztschr. Angew. Chem., [illegible], No. 14, p. [illegible]*).

The determination of ergot of wheat in flour, A. MILLER (*Rev. Internat. Falsif., 11 (1898), No. 1, p. 20; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. [illegible]*).

The detection of formic aldehyde in feeding stuffs, A. JORISSEN (*Rev. Internat. Falsif., 11 (1898), No. 1, p. 12; abs. in Ztschr. Angew. Chem., 189[illegible], No. 14, p. [illegible]*).

The total nitrogen in urine, L. MONFET (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. [illegible]*).—A modification of the Kjeldahl method said to be very exact is reported. The substance is oxidized with fuming Nordhausen sulphuric acid and manganese dioxid, and the resulting ammonium sulphate is decomposed by means of a strong solution of alkaline sodium hypobromite, the resulting nitrogen being measured in a eudiometer.

On Fehling's solution, M. Z. JOVITSCHITSCH (*Neue Ztschr. Rübenz. Ind., [illegible] (189[illegible]), No. [illegible], pp. [illegible]*).—The author shows that Fehling's solution is reduced by mineral acids, H_2SO_4, HNO_3, and HCl, when these are added in such quantities that the solution still gives an alkaline reaction with litmus paper, and explains it by a decomposition of the tartaric acid by the stronger acids. This change also takes place when Fehling's solution is kept for a length of time in well-stoppered glass bottles.—F. W. WOLL.

Ash of Gidgea acacia (stinking wattle), F. B. GUTHRIE (*Agr. Gaz. New South Wales, [illegible] (18[illegible]), pp. [illegible]; abs. in Jour. Chem. Soc. [London], 74 (189[illegible]), No. [illegible], II, p. [illegible]*).—The ash contained lime [illegible].71, potash 0.6, soda 0.72, phosphoric acid 1.47 per cent. The dry matter of the leaves contained 26.9[illegible] per cent of protein.

Composition of the ash of canary seed, T. S. HOFMAN (*Landbouw. Tijdschr., 5 (1897), pp. [illegible]; abs. in Jour. Chem. Soc. [London], 74 (1898), No [illegible], II, p. [illegible]*).

A new process for determining starch in the grain of cereals, L. LINDET (*2. Congrès Internat. Chim. Appl., 18[illegible], II, pp. [illegible]*).—See p. 17.

New extraction apparatus for the determination of fat, LOUISE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 73, 74, fig. 1*).

Apparatus for rapid and accurate determination of milk fat, E. M. ARNDT (*Milch Ztg., [illegible] (189[illegible]), No. [illegible], p. [illegible]*).—The apparatus is intended to facilitate the determination of fat in milk by the Krug-Hampe method (absorption of milk by

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[1] Ztschr. Angew. Chem., 1894, p. 683.

kaolin and anhydrous sodium sulphate, solution of the fat by ethyl ether, evaporating an aliquot part of the solution and weighing the residue.—F. W. WOLL.

Hydrogen generator, C. ASCHMAN (*Chem. Ztg., 21 (1897), No. 100, p. 1049, fig. 1*).—The essential parts are a filter flask with an exit tube for the gas affixed, and a cylinder of zinc attached to a glass rod, which slides up or down at will through a perforation in the rubber stopper. By this means the zinc may be lowered into the acid in the flask or raised out of it at pleasure.—J. T. ANDERSON.

A burette with a new glass cock (*Chem. Ztg., 21 (1897), No. 99, p. 1041, figs. 2*).—This burette terminates below in a thickened, stopper-like arrangement, with a lateral opening about half way down. Fitting over this is a ground glass, cone-shaped hood, which is provided with an outlet tube. This hood is movable laterally, and thus its outlet tube may be brought into connection with the aperture of the stopper when the liquid from the burette escapes. A slight turn either way closes the burette.—J. T. ANDERSON.

A new extraction apparatus, H. GÖCKEL (*Ztschr. Angew. Chem., 1897, No. 21, p. 683*).—This apparatus is recommended for the extraction of both solids and liquids with extraction fluids either lighter or heavier than the material to be extracted. It is made of sufficient size to accommodate 125 gm. of liquid or 150 gm. of solid matter.—J. B. LINDSEY.

A new measuring pipette, O. BLEIER (*Chem. Ztg., 21 (1897), No. 98, p. 1028, fig. 1*).—The instrument consists of a succession of four bulbs and terminates in a stem so constructed that the bulbs and the stem are of exactly the same volume (say 10 cc.) and have graduation marks accordingly. The stem is subdivided into tenths and hundredths. The pipette is filled by a suction tube at the top, and this tube is provided with a pinch cock, by means of which the outflow of the liquid is regulated. If 10 cc. or less is wanted, fill the stem only—that is, to the first 10 cc. division—and allow the desired quantity to flow out. If more than 10 cc. and not more than 20 cc. is desired, fill the stem and the first bulb—that is, to the second 10 cc. mark—and allow the desired volume to flow out. This form may be used for burettes as well as for pipettes.—J. T. ANDERSON.

Regulations for the construction and calibration of measuring apparatus proposed by the Association of German Chemists (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 375–378*).

On normal saccharimeter weights, H. COURTONNE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 397–400*).

Graduation of saccharimeters, A. JOBIN (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 379–390*).

Unification of saccharimetric scales, D. SIDERSKY (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 391–396*).

Report on agricultural-chemical work, V. STEIN (*Tidsskr. Landökon., 16 (1897), No. 5–6, pp. 649–674*).—The main results are given of the analyses of 7,114 samples of agricultural products made during 1897, with general discussions. The number of samples of various products analyzed was as follows: Feeding stuffs, 496; artificial fertilizers, 1,265; dairy products, 5,312 (viz, milk, 2,581; butter, 2,695; and cheese, 36); manures, 37; soils and marls, 10; root crops, 16; and sundry products, 8.—F. W. WOLL.

BOTANY.

Notes upon bean and pea tubercles, B. D. HALSTED (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 77–81*).—The author calls attention to some observations made upon the prevalence of root tubercles under varying conditions of growth of the host plants. In his experimental work at the New Jersey Station he found that in every case there was a decided

increase in yield of beans on soils where several successive crops of beans had been grown over the yield where grown on a soil for the first time. The roots of the plants growing upon old ground were supplied with rather abundant tubercles, with the exception of a portion of a plat which was shaded. Here the tubercles were much less abundant. In the new soil the tubercles were usually almost entirely absent, and during the days of thinning the plants, about twelve days after planting, almost none were observed. At the same time they were very abundant upon the plants in the old ground. This seems to indicate that the root tubercle organisms were present in unusual amount in the old land and in comparatively limited amount in the soil of the new plats.

The study reported on tubercles on the roots of peas was in connection with experiments made to test different kinds of soil treatment on the crop. One portion of the land had received sulphur, a second corrosive sublimate, a third carbonate of lime, and a fourth copper sulphate. All these substances were spread on the soil and spaded in for the second crop of the previous year and consequently had been in the soil for several months before the crop under consideration was sown. The plants were pulled at frequent intervals throughout the growth of the crop and the small proportion of tubercles on the plat where sulphur had been used was noted, the number being less than one-tenth of that where the soil had received no treatment. In the other plats, while there was some difference in the root systems of the plants, there was no decrease in the amount of root tubercles.

Comparisons were made between the tubercles on the roots of beans and peas. The differences in structure and external appearance were so striking as to almost suggest a separate origin. The difference in the root systems of the two plants, however, would probably account for the difference in form of the tubercles.

Some botanical notes on corn, L. H. PAMMEL and R. COMBS (*Iowa Sta. Bul. 36, pp. 849–855, figs. 8*).—Brief notes are given on the origin of corn, and on studies of the flower, fruit, germination, diseases, and enemies of the plant. A few experiments on the germination of corn in the laboratory, greenhouse, and field are reported, in which there was generally a slight loss in the field germination as compared with the others. There are reported three diseases of corn as prevailing in the State, namely, smut, rust, and a bacterial disease.

The flora of Kansas, A. S. HITCHCOCK (*Industrialist, 24 (1898), No. 3, pp. 190–198, pls. 4*).—Notes are given on the flora of the State. Maps show the distribution of the different species by counties.

A revision of the genus Cordiceps, G. MASSEE (*Rev. Mycol., 20 (1898), No. 78, pp. 49–57, pls. 3*).—Translated by R. Ferry.

The Rocky Mountain species of Thermopsis, A. NELSON (*Bot. Gaz., 25 (1898), No. 4, pp. 275, 276, pl. 1*).—*Thermopsis divaricata* and *T. arenosa* are described as new species.

Studies on surface tension and cohesion, Z. KAMERLING (*Bot. Centbl., 73 (1898), Nos. 11, pp. 369–374; 12, pp. 439–444; 13, pp. 465–473*).

Flowers and insects, C. ROBERTSON (*Bot. Gaz., 25 (1898), No. 4, pp. 229–245*).

The organography of plants with special reference to the Archegoniates and

Spermatophytes, I, K. GOEBEL (*Organographie der Pflanzen, insbesondere der Archegoniaten und Samenpflanzen. Jena: G. Fischer, 1898, pp. IX+232, figs. 130*).

The appearance of sex in the higher fungi, G. VON BECK (*Verhandl. K. K. Zool. Bot. Gesell. Wien, 48 (1898), No. 1, pp. 4–6*).

Influence of nutrition on the evolution of plants, P. DANGEARD (*Botaniste, 6. ser., 1898, No. 1, pp. 1–63*).

On the summer germination of the spores of truffles and the production of teleutospores, A. DE GRAMONT DE LESPARRE (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 5, pp. 443–447, figs. 9*).

On winter germination and fertilization, A. DE GRAMONT DE LESPARRE (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 3, pp. 281–285, figs. 5*).

Alinite, H. JENSEN (*Ugeskr. Landm., 42 (1897), No. 47, pp. 629, 630*).—A pure culture of *Bacterium ellenbachensis*, prepared by Caron, which is claimed to do for the small grains what Nitragin has been shown to do for the legumes. Experiments by Hartlieb at the Bonn experiment station have, however, failed to show any merit in the new preparation.—F. W. WOLL.

The nitrogenous coloring material of fungi, R. VAN DEN DRIES (*Cellule, 13 (1897), II, pp. 415–446*).

Investigations concerning chlorophyll, G. BODE (*Inaug. Diss, Jena, 1898, pp. 40*).

Concerning the transpiration of Halophytes, O. ROSENBERG (*Ofvers. K. Svenska Vetensk. Akad. Forhandl., 54 (1897), No. 9, pp. 531–549*).

Means of defense in plants, A. GILKINET (*Bul. Acad. Roy. Sci. Belg., 3. ser., 33 (1897), No. 12, p. 21*).

Concerning the elongation of nodes, P. VAN TIEGHEM (*Ann. Sci. Nat. Bot., 8. ser., 5 (1897), No. 1–2, pp. 155–160*).

Phosphorescent sap in the higher plants, M. W. BEIJERINCK (*Nature, 57 (1898), No. 1483, p. 511*).—Notes the occurrence of phosphorescent sap in *Euphorbia phosphorea*.

Polyembryony and its morphology in Opuntia vulgaris, W. F. GANONG (*Bot. Gaz., 25 (1898), No. 4, pp. 221–228, pl. 1*).

Concerning reduction phenomena in plant nuclei, W. BELAJEFF (*Ber. Deut. Bot. Gesell., 16 (1898), No. 2, pp. 27–34, figs. 3*).

Concerning the translocation of nutrient materials at the death of the leaves, G. RAMANN (*Ztschr. Forst u. Jagdw., 30 (1898), No. 3, pp. 157–166*).

The reserve matter of Ficaria ranunculoides, LECLERC DU SABLON (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 12, pp. 913–915, fig. 1*).

On the cholesterins of the lower plants, E. GÉRARD (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 12, pp. 909–911*).

Experiments in the cross-fertilization of willows (*Jour. Bot.* [*London*], *36 (1898), No. 424, pp. 122–124*).

Laboratory manual in practical botany, C. H. CLARK (*New York: The American Book Co., pp. 271*).

ZOOLOGY.

The jack rabbits of the United States (*U. S. Dept. Agr., Division of Biological Survey Bul. 8, pp. 84, pls. 6, figs. 2, maps 3*).—*Introduction* (pp. 1–23).—A popular description is given of the various species of jack rabbits of the United States, their food habits, depredations, distribution, etc. The species noted, found in the United States, are the prairie hare or white-tailed jack rabbit (*Lepus campestris*), which has a range extending over the northern part of the Great Basin and the Great Plains westward from central Iowa, but probably never occurs in such numbers as the black-tailed jack rabbit; the California jack

rabbit (*L. californicus*), which, according to recent investigations is restricted entirely to the region west of the Sierra; the black-tailed rabbit or Texan jack rabbit (*L. texianus*); the black eared jack rabbit or eastern jackass hare (*L. melanotis*), found on the Great Plains from eastern Kansas to the Rocky Mountains and western Texas; Allen's jack rabbit (*L. alleni*) of the deserts of southern Arizona and Sonora; and the Rio Grande jack rabbit (*L. merriami*) of the lower Gulf coast and the Rio Grande region as far as the mouth of Devils River.

Abundance and rapidity of increase (pp. 24–29).—In this chapter it is shown that the breeding habit of the rabbits is such (on an average three per litter and a litter every three months) as to make the animals increase with extreme rapidity, though the evidence on hand does not substantiate the view that the rabbits breed every six weeks in the year. Each species seems to have a regular breeding season and a definite period of rest, for no data are at hand that show that the young are born within the United States during the months of October, November, and December. But it may be said that the period of gestation is about thirty days and that it takes about two months for the young to reach maturity. The practical bearing of these facts is more or less obvious. Drives or hunts for the extermination of rabbits should take place before the beginning of the breeding season. In southern California they should be made in December, January, February, or early in March; in Colorado and Utah, the 1st of February; in Idaho, somewhat later.

Injury to crops and means of protection (pp. 30–35).—The rabbit attacks most garden plants and the bark of orchard trees and seldom ignores alfalfa. Five jack rabbits, it is estimated, consume as much food as one sheep. The method of protection advised is the construction of fences of boards or wire about fields, the use of burlap, and whitewash on single trees.

Methods of destruction (pp. 36–46).—The method of inoculating with chicken cholera or with the so-called tintinallogy disease and the propagation of the bladder worm and the rabbit scab (*Sarcoptes cuniculi*), rabbit measles (*Cysticercus pisiformis*), and the liver coccidium (*Coccidium oviforme*) as tried in Australia is briefly noted, with the comment that the diseases caused by parasites offer little hope as a means of destruction.

Of the various methods of poisoning, the use of strychnin is thought most worthy of recommendation. Paris green, London purple, lead salts, tartar emetic, barium carbonate, and sulphate of iron and corrosive sublimate, on the other hand, have not been found successful. Phosphorus has been advocated, and means of using it are described.

The bounty methods as followed in Arizona, California, Idaho, Kansas, Nevada, Oregon, Texas, Utah, Washington, and Australia and the amount of money expended are briefly noted.

The natural enemies of the jack rabbits mentioned are the barn owl

(*Strix pratincola*), Audubon's caracara (*Polyborus cheriway*), prairie falcon (*Falco mexicanus*), western red-tailed hawk, western horned owl (*Bubo virginianus subarcticus*), golden eagle (*Aquila chrysaetos*), marsh hawk (*Circus hudsonius*), various cayotes, wolves, and foxes. It is pointed out, however, that birds of prey seldom molest the larger hares.

The epidemics to which they are subject are more or less local and occasionally reduce their numbers materially. A tabular partial list of the epidemics in the West is given.

Rabbit drives and hunts (pp. 47–64).—The formation of rabbit drives and hunts as followed in southern California, Oregon, Utah, Idaho, and Colorado is described. The following table summarizes the results noted:

General summary of 305 jack rabbit drives and hunts in the West.[1]

	California, 1875–1897.	Colorado, 1893–1896.	Idaho, 1894–1897.	Oregon, 1894–1895.	Utah, 1894–1896.	Total.
Number of drives	[2]217	[3]12	[2]29	[4]12	[2]35	305
Total number of rabbits killed	494,634	33,063	34,329	12,202	61,318	635,546
Average number per drive	2,389	2,755	1,271	1,016	1,752	2,175
Largest drives	20,000	6,500	5,000	2,000	5,500	....

[1] Including 10 from California and 2 from Idaho for which no figures are available. These drives are not considered in obtaining the averages.
[2] Both drives and hunts. [3] Hunts. [4] Drives.

The value of the jack rabbit (pp. 65–79).—In this chapter the value of jack rabbits for coursing, for their skins, as game, and for canning, is discussed. It is thought that the canning industry, especially in California, might be very profitable and might make the rabbit pay largely for its own destruction.

The jack rabbits of the United States, T. S. PALMER (*U. S. Dept. Agr., Division of Biological Survey Bul. 8, rev., pp. 88, pls. 6, figs. 3, maps 3*).—Largely a reprint of the first edition. The additions note a special subgenus (Macrotolagus), and give further data on the subject of bounties and on rabbit drives as carried on in California and Idaho during 1896 and 1897. An appendix gives an account of an Indian rabbit hunt of the 16th century, and of the modern hunts of the Pueblo Indians, which were very similar in many respects to the rabbit drives of California. In the Fresno rabbit drive of March 21, 1896, at least 20,000 rabbits were corralled and killed.

Some insectivorous mammals, R. ELLIOTT (*Rpt. Ontario Ent. Soc., 1896, pp. 16–21, figs. 4*).—The distribution and usefulness of the little brown bat (*Vespertilio gryphus*), the silvery bat (*Lasionycteris noctivagans*), the brown bat (*Adelonycteris fuscus*), the red bat (*Atalapha noveboracensis*), the hoary bat (*A. cinerea*), the Carolina bat (*Vesperugo carolinensis*), the star-nosed mole (*Condylura cristata*), the shrew mole (*Scalops aquaticus*), the hairy-tailed or brewer's mole (*Scapanus americanus*), the short-tailed shrew (*Blarina brevicauda*), Cooper's shrew (*Sorex cooperi*), broad-nosed shrew (*S. platyrhinus*), the raccoon (*Procyon lotor*), and the skunk (*Mephitis mephitica*) are briefly noted.

Yeast and alcoholic fermentation, J. R. GREEN (*Nature, 57 (1898), No. 1486, pp. 591–594*).—The author summarizes the present information relating to these subjects.

METEOROLOGY.

Solar and terrestrial magnetism in their relations to meteorology, F. H. BIGELOW (*U. S. Dept. Agr., Weather Bureau Bul. 21, pp. 176, charts 39*).—This is a technical explanation of the author's theory that the atmospheric conditions which culminate in the storms traversing the United States are in part due to the direct magnetic action of the sun upon the earth, in which an attempt is made to correlate the observations bearing on this subject into general scientific laws. The general topics treated are the relation between magnetism and meteorology, the determination of the 26.68-day solar magnetic period, analysis of the polar magnetic field along the terrestrial meridians, deflecting forces of the equatorial electromagnetic field, some relations between the terrestrial magnetic field and the meteorological elements, and solar magnetism.

Oklahoma weather and crops for 1897, G. E. MORROW (*Oklahoma Sta. Bul. 30, pp. 12*).—A general account of the soil, meteorological conditions, and agricultural products of Oklahoma, with a record of temperature and rainfall in 1897 as compared with previous years at a number of places in the Territory.

Meteorological observations, J. E. OSTRANDER and A. C. MONAHAN (*Massachusetts Hatch Sta. Met. Buls. 109, 110, 111, pp. 4 each*).—These bulletins contain notes on the weather and the usual summaries of meteorological observations during January, February, and March, 1898.

Meteorological observations in Denmark, 1896-97 (*Holt's Lommebog Landm., 1898, pp. 88, 89*).

Forestal meteorological studies, E. HOPPE (*Centbl. Gesam. Forstw. Wien, 24 (1898), No. 4, pp. 147-166*).

WATER—SOILS.

The soils of Tennessee, C. F. VANDERFORD (*Tennessee Sta. Bul., Vol. X, No. 3, pp. IV+31-139, figs. 37, maps 3*).—This is a preliminary report on a systematic survey of the soils of Tennessee, commenced about 6 years ago.

"It is not intended as a complete treatise on the subject. The station has a considerable amount of material which must be reserved for future discussion. This bulletin contains, after a description of the objects and methods of the survey, the physical and chemical analyses and climatological and botanical relations of a number of the most important typical soils of Tennessee. The notes made by the agriculturist on the agricultural treatment of the soil have been pretty fully incorporated for the purpose of interesting the practical farmer.

"The bulletin is accompanied by the preliminary soil map of the State, which was compiled by the station, with the assistance of the United States Geological Survey and the Division of Soils of the United States Department of Agriculture. For the purposes of instruction and further study, this soil map has been put upon a relief map of Tennessee 10 ft. 4 in. long by 2 ft. 10 in. wide, which was prepared by the station in cooperation with the United States Geological Survey. A half-tone plate made from a photograph of this relief-map model is inserted in the bulletin."

Mechanical analyses by M. Whitney, of this Department, and chemical analyses by J. B. McBryde of fifteen samples of soils (with, in some

cases, corresponding subsoil) are reported. The regions and geological formations represented are the Knox dolomite (near Knoxville), the Lenoir limestone of Loudon County, Knox shales of Monroe County, sandstone of Greene County, sandstone and conglomerate overlying coal measures in Grundy County, St. Louis (coral) limestone of Franklin County, the "barrens" of the highlands of Coffee County, blue limestone of the Nashville formation in Maury County, St. Louis (coral) limestone of Robertson County, sandy cretaceous of Benton County, flatwoods (Porters Creek group of Safford), Paris clay of Carroll County, Columbian deposits (Lagrange sands overlaid by orange sands) of Gibson and Fayette counties, and Columbian deposits (the loess, bluff loam of Safford) of Dyer County.

The agricultural value and the best methods of management of the different soils are very fully discussed, especial attention being given to the necessity of protection against washing and the maintenance of a sufficient supply of humus in the soil.

A brief account is given of an experiment on four plats of soil on the station grounds with barnyard manure and different mixtures of commercial fertilizers. The crops grown were corn followed by soy beans and cowpeas. Chemical analyses, including the determination of phosphoric acid and potash soluble in 1 per cent citric acid, were made at the beginning and the end of the experiment. The results indicate that the barnyard manure was not only very effective as a direct fertilizer, but was more active than the other fertilizers in rendering the phosphoric acid and potash of the soil assimilable.

The author concludes that on four-fifths of the farm lands of Tennessee "the use of commercial fertilizers, or fertilizer materials, must come more and more into practice. The making, saving, and use of farm manures, the growing of crops specially planted for the purpose of adding to the humus supply, the careful husbanding of all materials which may be incorporated into the soil to aid in chemical, physical, and biological changes which must be actively persistent if fertility is to be maintained, are acknowledged necessary things."

Soil moisture, J. B. WEEMS and J. J. EDGERTON (*Iowa Sta. Bul. 36, pp. 825–848*).—This is an account of a continuation during 1896 of work commenced in 1895:[1]

"In addition to the effect produced upon the moisture present in the soil by certain crops, attention was given to the influence of spring plowing, fall plowing, and fall plowing with subsoiling, upon the amount of moisture in connection with growing crops. The soil upon which the experiments were made was of as uniform a nature as possible, in order to reduce the influence of the difference in the mechanical condition to a minimum. The weight of the soil varied according to the depth, and the weight for each cubic foot is given in the following table: First cubic foot, 70.23 lbs.; second cubic foot, 98.38 lbs.; third cubic foot, 94.78 lbs.; fourth cubic foot, 103.60 lbs. The above weights are for the air-dried soil, which contained moisture as follows: 2.88 per cent for the first, 2.84 per cent for the second, 1.80 per cent for the third, and 1.30 per cent for the fourth cubic foot."

[1] Iowa Sta. Bul. 32 (E. S. R., 8, p. 477).

Mechanical analyses[1] of the soil are given in the following table:

Mechanical analyses of the soil at different depths.

	First foot.	Second foot.	Third foot.	Fourth foot.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Organic matter, loss on ignition	2.878	2.843	1.789	1.269
Coarse gravel	.411	.047	.642	3.783
Fine gravel (2 to 1 mm.)	.362	.213	1.018	1.764
Coarse sand (1 to 0.5 mm.)	7.284	7.678	11.904	13.354
Medium sand (0.5 to 0.25 mm.)	3.375	3.646	5.091	4.960
Fine sand (0.25 to 0.1 mm.)	3.577	17.489	24.949	23.610
Very fine sand (0.1 to 0.05 mm.)	17.212	21.673	20.919	22.730
Silt (0.05 to 0.01 mm.)	33.477	21.354	17.621	15.225
Fine silt (0.01 to 0.005 mm.)	6.346	7.410	2.343	1.891
Clay (0.005 to 0.0001 mm.)	6.366	11.944	9.975	8.957
Total	99.946	100.078	100.098	100.042

Tables record weekly observations on the rainfall and the moisture content to depths of 4 in., 4 in. to 1 ft., 1 to 2 ft., 2 to 3 ft., and 3 to 4 ft. on the different plats for the period from April 16 to October 23. The rainfall during this period "was 27.77 in., or 3,141.45 tons of water per acre. This amount of rain was larger than the quantity necessary to supply the wants of the crops."

The averages of the moisture determinations are given in the following table:

Average moisture content of soils, April 16 to October 23, 1896.

	Surface to 4 in.	4 in. to 1 ft.	1 to 2 ft.	2 to 3 ft.	3 to 4 ft.	Average.
Bare cultivated soil:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Spring plowed	21.04	21.19	19.32	17.14	15.22	18 20
Fall plowed, subsoiled	21.75	21.81	19.97	17.96	13.66	18.34
Fall plowed, not subsoiled	20.99	21.07	19.47	16.69	14.80	18.06
Bare not cultivated:						
Spring plowed	20.38	21.41	19.81	18.34	14.65	18.47
Fall plowed, subsoiled	19.55	21.03	19.68	16.61	13.02	17.46
Fall plowed, not subsoiled	17.94	19.77	17.52	14.61	12.75	16.01
Clover plats:						
Spring plowed	19.50	19.18	18.59	17.44	14.92	17.56
Fall plowed, subsoiled	19.93	19.84	17.59	15.04	13.58	16.52
Fall plowed, not subsoiled	18.06	17.53	15.72	13.28	11.58	14.57
Oat plats:						
Spring plowed	19.78	19.82	18.47	15.96	11.05	16.32
Fall plowed, subsoiled	19.83	19.39	17.62	14.25	10.55	15.49
Fall plowed, not subsoiled	17.99	17.80	16.12	13.16	11.08	14.55
Barley plats:						
Spring plowed	19.46	19.72	18.46	15.13	9.21	13.11
Fall plowed, subsoiled	19.45	20.15	17.36	14.55	12.47	16.08
Fall plowed, not subsoiled	17.88	17.93	16.03	12.66	9.63	14.06
Beet plats:						
Spring plowed	20.51	20.77	18.23	14.53	10.17	15.90
Fall plowed, subsoiled	21.16	21.38	19.45	17.30	16.19	18.56
Fall plowed, not subsoiled	19.69	19.57	17.52	14.08	9.99	15.30
Corn plats:						
Spring plowed	18.69	19.55	17.74	14.16	12.52	15.92
Fall plowed, subsoiled	19.67	20.45	18.67	16.32	12.34	16.88
Fall plowed, not subsoiled	18.96	19.81	17.88	15.05	10.87	15.83
Blue-grass pasture	19.86	17.60	15.68	12.24	11.94	14.55

[1] Made by I. J. Mead.

The amount of moisture found in the plats July 10 may be taken as representing the condition of the soil during the dry period. The averages for this date on some of the plats are given as follows: Clover plat: Spring plowed, 12.52 per cent; fall plowed, subsoiled, 11.39 per cent; fall plowed, not subsoiled, 9.38 per cent. Oat plat (to a depth of 3 ft.): Spring plowed, 10.86 per cent; fall plowed, subsoiled, 10.87 per cent; fall plowed, not subsoiled, 8.50 per cent. Barley plat: Spring plowed, 11.26 per cent; fall plowed, subsoiled, 10.36 per cent; fall plowed, not subsoiled, 8.32 per cent. Beet plat: Spring plowed, 15.31 per cent; fall plowed, subsoiled, 18.05 per cent; fall plowed, not subsoiled, 12.69 per cent. Corn plat: Spring plowed, 15.51 per cent; fall plowed, subsoiled, 16.29 per cent; fall plowed, not subsoiled, 16.23 per cent.

"The amount of moisture present in the pasture was uniform for the season when compared with the changes which take place in many of the other plats. This characteristic of the blue-grass plat compares favorably with the results of 1895."

Mechanical analyses and water content of Wyoming soils, C. B. RIDGAWAY (*Wyoming Sta. Bul. 35, pp. 159–188, pls. 5, charts 3*).—This is a continuation and extension of work reported in Bulletin 6 of this station (E. S. R., 4, p. 23).

The general characteristics of what were considered typical Wyoming soils at the station and substations are described, with notes on natural vegetation and maximum yields of different farm crops. Mechanical analyses of three samples of soil with corresponding subsoil collected at Wheatland, Sundance, Sheridan, Lander, and Laramie are reported. Chemical analyses of soils and subsoils from each of the above farms are republished from the bulletin above referred to, and a record is given of daily determinations of moisture during the period from April to September on prairie sod and on cultivated (plowed and harrowed) and subsoiled plats (the last two being seeded to oats) on the station farm at Laramie. For purposes of comparison, observations on rainfall and evaporation are also reported.

The average results of the mechanical analyses are shown by the following table:

Mechanical analyses of Wyoming soils.

	Wheatland.	Sundance.	Sheridan.	Lander.	Laramie.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Gravel	1.05	0.17	0.22	0.21	5.78
Coarse sand	1.85	.15	.56	.21	3.79
Medium sand	8.60	.80	10.56	.67	7.77
Fine sand	15.09	1.93	34.33	3.44	5.90
Very fine sand	40.16	51.49	19.03	54.74	29.00
Silt	6.18	20.93	5.73	16.66	5.39
Fine silt	4.33	3.69	1.90	4.43	2.92
Clay	15.19	13.09	20.28	13.36	22.98

The results of the mechanical analyses as well as of the moisture determination are shown graphically. From the latter it was found "that the amount of moisture in samples of the same soil, taken the same

day and not more than 12 in. apart, varied from 2 to 4 per cent." The maximum water content was found two or three days after a heavy fall of rain, "which is doubtless caused by seepage of water from a higher level." The minimum amount of water was about 5 per cent, and this was observed at the end of June. At the end of the season the prairie sod contained 6 per cent of moisture, the cultivated soil $6\frac{1}{2}$ per cent, and the subsoiled land $8\frac{1}{2}$ per cent.

The electrical method of moisture determination in soils, F. D. GARDNER (*U. S. Dept. Agr., Division of Soils Bul. 12, pp. 24, fig. 1, charts 6*).—As a result of field trials of the electrical method of moisture determination in soils described in a previous bulletin,[1] "some slight modifications in the apparatus and in the method of its operation which will greatly facilitate the taking of the observations and the calculations of the results" are suggested. These include modifications of the electrodes to insure more perfect insulation and to adapt them to "very light sandy soils having a low salt content and small water capacity," the use of lead-covered underground wires for connecting the electrodes, and precautions regarding the cleaning of the different parts of the instrument. The standardization of the electrodes by means of direct determinations of moisture in soil is explained, and observations on the effect of the distance between electrodes on the resistance are reported.

"[During the year] fourteen sets of the instruments were placed in the hands of farmers located in widely different sections of the country and on markedly different types of soil. Observations were made daily of the electrical resistance of the soil at the depths of 1 to 3, 3 to 6, 9 to 12, and 21 to 24 in., except in a few instances where the 1 to 3 in. depth was omitted on account of the very loose and dry condition of the surface soil. The observations were taken during the crop season of the particular locality and extended over periods of from three to four and one-half months, the average time being approximately four months for each observer."

The results of these observations are reported in charts and tables. The bulletin also contains a note by T. H. Means on a modification of the electrical method of determining the soluble salt content of soils.[2]

"It has been found that this method is not applicable to soils containing a large amount of soluble salt, as with the alkali soils of the West, for the salt added materially changes the amount of dissociated salt in the soil. This led to a careful review of the work which had previously been done, and it appears probable that the apparent influence of the texture of the soil . . . is largely due to the effect of the added salt upon the dissociated salt content of the soil. Correcting for this, the influence of the texture of a soil upon the resistance of a solution seems to be a constant which does not vary with the nature of the soil, provided the soil is thoroughly saturated with water. This factor has not been established with great accuracy as yet, but it appears to be approximately 0.54 or 0.56."

The chemical composition of Utah soils, J. A. WIDTSOE (*Utah Sta. Bul. 52, pp. 37–84*).—This is a report of the first of a proposed series of systematic studies of the soils of Utah, and is devoted to the soils of Cache and Sanpete counties. It includes a general discussion of the

[1] U. S. Dept. Agr., Division of Soils Bul. 6 (E. S. R., 9, p. 535).
[2] U. S. Dept. Agr., Division of Soils Bul. 8 (E. S. R., 9, p. 535).

relation of the plant to the soil, suggestions regarding the maintenance and increase of fertility of Utah soils, descriptions of the Cache and Sanpete Valleys, and chemical analyses of 37 samples of soils from Cache County and 18 samples from Sanpete County. The averages of these analyses are given in the following table:

Composition of soils from Cache and Sanpete counties, Utah.

	Average of Cache County soils.	Average of Sanpete County soils.
	Per cent.	Per cent.
Insoluble residue	81.09	58.85
Potash (Ka_2O)	.99	.78
Soda (Na_2O)	.53	.62
Lime (CaO)	1.78	12.50
Magnesia (MgO)	.73	.84
Oxid of manganese (Mn_3O_4)	.03	.16
Oxid of iron (Fe_2O_3)	2.95	2.71
Alumina (Al_2O_3)	5.61	8.41
Phosphoric acid (P_2O_5)	.22	.19
Carbon dioxid (CO_2)		10.14
Organic matter	6.34	4.83
Total	100.27	100.03
Humus	1.990	2.140
Nitrogen (average of 13 determinations)	.128	.114
Water at 15° C	2.370	1.830

"The general nature of Cache Valley soils is that of a moderately clayey loam. The soils on the hillsides, which have been influenced by the seasonal wash from the mountains, contain most clay. The soils along the middle of the valley are more sandy, although occasional tracts of clay soils occur.

"Cache Valley soils do not differ much in composition from the majority of the soils of the arid part of America. They are abundantly supplied with all the essential plant foods, and, with proper tillage, will 'last' for an indefinite period. Phosphoric acid is present in least abundance. . . .

"The general nature of Sanpete Valley soils is that of a rather clayey soil mixed with an extraordinarily large amount of lime. The excess of lime obscures the properties of the clay.

"In composition the soils of Sanpete Valley differ from recorded analyses of soils from other portions of the Great Basin in that they contain more lime. Otherwise they are not strikingly different. They are extremely fertile soils that 'last' for an indefinite period. As in Cache Valley soils, the phosphoric acid is least abundant."

Drinking water, N. E. Wilson (*Nevada Sta. Bul. 34, pp. 16*).—Tables give analyses, with reference to sanitary condition, of 79 samples of drinking water from different parts of the State, accompanied by explanation of terms used in discussing water analysis and remarks on the dissemination of disease through drinking water.

On the relation between geological formations and the composition of the soil, A. Bernard (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 256–266, dgms. 6*).—The soils of Saône-et-Loire are arranged on the basis of their chemical and physical analyses in 6 classes, and the relationship between physical constitution and chemical composition is plotted in diagrams.

(1) The granitic soils, represented by 90 analyses, are generally poor in phosphoric acid, and destitute of lime.

(2) Clay soils, represented by 22 analyses, are compact and tenacious, poor in phosphoric acid, and rich in potash.

(3) The Lias soils in the 3 stages of transformation, represented by 75 analyses, are remarkably rich in phosphoric acid and potash.

(4) The calcareous soils, represented by 53 analyses, are very fertile and less tenacious than the preceding.

(5) Soils of the Oxford formation, represented by 90 analyses, are strong, rich, clayey calcareous soils.

(6) Ferruginous clays and sands, represented by 230 analyses, are very poor soils, extremely deficient in lime and phosphoric acid.

On the determination of the available constituents of the soil, C. V. GAROLA (*2. Congres Internat. Chim. Appl., 1896, II, pp. 143–150*).—Determinations of the potash and phosphoric acid in fertilized and unfertilized soils soluble in strong nitric acid (100 cc. of nitric acid 1.4 sp. gr. and 50 cc. water to each 50 gm. soil), 2 per cent citric acid, and nitric acid of the same acidity (0.013 per cent of hydrogen) as the average found by Dyer in the juice of plant roots.[1]

The relation between the amounts of phosphoric acid soluble in these different reagents and the productiveness of the soil, as well as the influence of applications of different phosphates upon the amount and availability of the phosphoric acid of the soil, are discussed.

FERTILIZERS.

On Wiborgh phosphate, its manufacture and agricultural value, L. F. NILSON (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 1, pp. 49–63*).—This new fertilizer, which promises to become of the highest agricultural importance, is manufactured by a process invented by J. Wiborgh, of the Technological Institute of Stockholm (Sweden). Briefly stated, the phosphate is prepared by fusing a thorough mixture of finely comminuted mineral phosphates, like apatite, and feldspar, with powdered sodium carbonate at a temperature of from 900 to 1,000° C. The reaction which takes place has been studied in a series of experiments by the author, and is expressed by the following formulas:

$$CaFl_2.\ 9CaO.\ 3P_2O_5+3Na_2O.\ CO_2=2Na_2O.\ 10CaO.\ 3P_2O_5+2NaFl+3CO_2.\ K_2O.\ Al_2O_3.\ 6SiO_2+2Na_2O.\ CO_2=K_2O.\ 2Na_2O.\ Al_2O_3.\ 6SiO_2+2CO_2.$$

The composition of the resulting product is shown by the following analysis: Phosphoric acid 27.01, silica 9.99, sulphuric acid (SO_3) 0.27, potassium oxid 1.54, sodium oxid 14.69, calcium oxid 38.12, magnesium oxid 2.88, iron and aluminum oxids 4.5, and fluorin (and errors of analysis) 1 per cent.

The Wiborgh phosphate may be easily ground to an exceedingly fine powder of limonite color. It dissolves in hydrochloric acid without residue, and is but slightly soluble in water even at higher temperatures. It is easily soluble in ammonium citrate solution, its percentage solubility being on the average 95 per cent, having been determined by Scandinavian and German chemists at from 93 to 96 per cent. The citrate solubility of the phosphate increases with the proportion of sodium carbonate used in fusing the apatite, up to the theoretical amount required for the reaction to take place, which is about 30 parts of sodium carbonate per 100 parts of apatite, the latter containing about 17 parts of feldspar.

[1] Jour. Chem. Soc. [London], 1894, p. 115; Chem. News, 69 (1894), p. 113 (E. S. R., 5, p. 1013).

Relation between amount of sodium carbonate used in fusion and the citrate solubility of the product.

	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Sodium carbonate added	20	22.5	25	27.5	30	32.5
Citrate solubility	67	70.0	74	87.0	93	93.0

The presence of feldspar in fusing apatite with sodium carbonate is important, since a high citrate solubility can not otherwise be obtained. Fusions with and without feldspar gave the following results: Pure apatite with 2 parts sodium carbonate, 37 per cent citrate solubility; with 3 parts sodium carbonate, 72 per cent; 83 parts pure apatite and 17 parts pure feldspar with 20 parts sodium carbonate, 64 per cent; 83 parts pure apatite and 17 parts pure feldspar with 30 parts sodium carbonate, 94 per cent.

The raw material for the manufacture of the Wiborgh phosphate is found in enormous quantities in Sweden in the Gellivare iron ore, from which the magnetic iron has been separated, leaving a finely divided refuse product of silicic apatite; four-fifths of the latter consists of pure calcium phosphate and one-fifth mainly of feldspar, with some quartz, mica, and hematite. The phosphoric acid content of the raw material reaches 35 per cent.

Fertilizer experiments.—Preliminary experiments made with Wiborgh phosphate during 1896 indicated that the phosphoric acid contained therein possessed a greater value than Thomas slag, approaching that of the water-soluble phosphoric acid in superphosphates. The experiments were continued on a somewhat larger scale in 1897 with oats grown in sandy soil and with peas and sugar beets grown in marsh soil. The Thomas phosphate used had a citrate solubility of 88 per cent. The glass cylinders used were 50 cm. high, 25 cm. in diameter, with a surface of 0.05 sq. meter. They were filled with 25 kg. sand in the oat experiments and with 15.5 kg. of marsh soil in the pea experiments. In case of the oats a basal fertilizer of 300 kg. potash (sulphate), 100 kg. nitrogen (nitrate), 2,000 kg. powdered marble, 200 kg. salt, and 200 kg. land plaster was applied; in case of the peas, 300 kg. potash (sulphate) and 200 kg. salt. The results obtained with the first two crops are summarized in the following table:

Pot experiments with Wiborgh and other phosphates on oats and peas.

	Rate of application of citrate-soluble or water-soluble phosphoric acid per hectare.											No phosphate.
	Wiborgh phosphate.				Thomas phosphate.				Superphosphate.			
	50 kg.	75 kg.	100 kg.	150 kg.	50 kg.	75 kg.	100 kg.	150 kg.	50 kg	75 kg.	100 kg.	
Yield of oats:												
Grain (grams)	27.4	31.2	32.8	37.9	26.3	31.8	33.9	36.6	19.6	26.6	31.3	8.5
Straw (grams)	33.1	39.6	43.2	46.6	32.3	39.2	43.0	46.9	21.9	33.5	40.0	10.2
Yield of peas:												
Peas (grams)	22.8	37.4	47.1	66.4	22.4	36.3	46.8	66.6	23.0	36.4	48.1	4.3
Vines (grams)	37.4	52.5	60.7	79.7	43.0	57.0	64.6	83.3	38.9	53.3	66.5	11.8

The experiments with sugar beets were made in glass cylinders 75 cm. high and 26 cm. diameter, cement-lined boxes of 1 cubic meter content, and zinc boxes with a surface of 0.3 square meter, the latter being placed in the ground. There were six trials in the cylinders and cement-lined boxes and five in the zinc boxes. In all cases the marsh soil used in the trials received sulphate of potash at the rate of 267 lbs. and sodium nitrate at the rate of 22 lbs. per acre. The following table gives the average results of the experiments:

Experiments with Wiborgh and other phosphates on sugar beets.

	Rate of application of citrate-soluble or water-soluble phosphoric acid per hectare.										
	Wiborgh phosphate.				Thomas phosphate.				Superphosphate.		
	50 kg.	75 kg.	100 kg.	150 kg.	50 kg.	75 kg.	100 kg.	150 kg.	50 kg.	75 kg.	100 kg.
In glass cylinders:											
Yield of beets (grams)	880	1,770	2,580	3,200	985	1,850	2,680	3,430	995	1,356	2,530
Sugar content (per cent)	16.38	17.16	17.23	18.15	16.00	16.00	16.92	17.46	16.62	16.00	17.08
In cement lined boxes:											
Yield of beets (grams)	4,340	5,210	6,650	7,610	5,150	6,120	6,180	7,600	3,720	5,520	6,140
Sugar content (per cent)	15.00	15.23	15.00	16.08	14.77	15.23	15.00	15.84	15.54	14.46	15.38
In zinc boxes:											
Yield of beets (grams)	2,672	2,998	3,120	3,475	2,678	3,066	3,110	3,582	2,815	3,238	3,000
Sugar content (per cent)	15.01	15.96	15.94	16.21	15.45	15.92	15.80	16.08	13.82	14.89	16.19

The soil used in the first two series of experiments was extremely deficient in available phosphoric acid, and in check experiments without applications of phosphate no crop was produced. The check experiments in the third series gave an average yield of 1,078 gm. of beets, with 13.27 per cent or 143.1 gm. of sugar. The results of the experiments show that Wiborgh phosphate is at least equal to Thomas phosphate or superphosphate for the culture of sugar beets on marsh soils.—F. W. WOLL.

The assimilation of nitric acid as well as the action of different nitrates, W. SCHNEIDEWIND (*Jour. Landw.*, *46* (*1898*), *No. 1*, *pp. 1–8*).—In experiments with sugar beets in 1894 and 1895, it was found that nitrate of soda acted more quickly than nitrate of potash, a fact which was attributed to the greater diffusibility of the sodium salt. Further experiments with different nitrates were made with oats grown on artificial soil (sand with $2\frac{1}{2}$ per cent of peat) in pots in 1896. The nitrogen was applied in the form of sodium, potassium, calcium, and magnesium nitrates. In addition to the nitrates, calcium carbonate, potassium phosphate, potassium sulphate, potassium chlorid, and magnesium sulphate were applied. The yield and analyses of the crop are tabulated. The largest yield of grain and the smallest yield of straw was obtained from the pot receiving magnesium nitrate. This is attributed to the

physiological rôle which magnesium plays in the formation of seeds. The opposite result was obtained with potassium nitrate. The amounts of nitrogen, phosphoric acid, and chlorin in the crop were practically the same in each experiment. The relative proportions of potash and soda vary to a considerable extent with the relative amounts applied to the soil. Thus, in the experiment with sodium nitrate the crop took up 4.32 gm. of potash and 9.17 gm. of sodium. In the experiment with potassium nitrate, the crop contained 9.08 gm. of potash and 5.39 gm. of soda. The amount of lime which the plant contained was not appreciably increased by the application of calcium nitrate. The proportion of magnesium in the grain, however, was decidedly increased by the application of magnesium nitrate to the soil.

Bacteria obtained from manure and their physiological rôle in the decomposition of manure, S. A. SEWERIN (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 23–24, pp. 628–633; 25–26, pp. 706–718, figs. 2*).—A number of organisms isolated from manure are described and culture experiments with them are reported. The action of some of these organisms was compared with that of *Bacillus pyocyaneus* on mixtures of horse manure and urine. The decomposition of the manure was measured by the carbon dioxid produced. The results indicate that the organisms were generally effective in reducing the organic matter only when urine was present, but that when the activity of the organisms was once started they not only reduced the organic matter in the urine, but also attacked that of the solid excrement.

Green manuring and the value of clovers and cowpeas in maintaining soil fertility, H. J. WATERS (*Missouri Sta. Rpt. 1897, pp. 26–33, figs. 2*).—Reprinted from Bulletin 34 of the station (E. S. R., 8, p. 969).

The economic value of farm manures, H. J. WATERS (*Missouri Sta. Rpt. 1897, pp. 20–25*).—Reprinted from Bulletin 34 of the station (E. S. R., 8, p. 969).

The agricultural value of Thomas slag, CLUSS (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 151–154*).—The author quotes experiments at Halle to prove that the citrate solubility is a reliable indication of the fertilizing value of the phosphoric acid in Thomas slag; that the phosphoric acid insoluble in the citrate solution is practically worthless for fertilizing purposes, and that fusing the slag with silica increases citrate solubility and fertilizing value.

Study on natural phosphates, H. LASNE (*2. Congrès Internat. Chim. Appl., 1896, III, pp. 24–90*).—This article discusses the origin, deposits, composition, and exploitation of the principal phosphates of the world, which are grouped in two classes, (1) sedimentary fluophosphates and (2) phosphates of animal origin. The method of analysis used in studying the composition of the different phosphates is given in detail.

Study on the use of phosphatic fertilizers on the subcretaceous soils of Puisaye, POTIER (*Ann. Sci. Agron., 1897, II, Nos. 1, pp. 136–160: 2, pp. 161–174*).

The phosphates of Algeria, J. DUGAST (*Rev. Gén. Sci. Pures et Appl., 8 (1897), No. 19, pp. 769–783, figs. 11*).—The origin, nature, extent, exploitation, and agricultural value of these phosphates are very fully treated.

Phosphatic slags, H. JOULIE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 167–173*).—Gives analyses of different samples and their solubility in ammonium oxalate, acetic acid, and ammoniacal ammonium citrate, according to Millot, with a brief dis-

cussion of assimilability, price, and adulteration. The action of ammonium oxalate was less vigorous than that of the acetic acid and citrate, depending upon the amount of calcium silicate present.

Report of analyses of commercial fertilizers for the fall of 1897, L. L. VAN SLYKE (*New York State Sta. Bul. 134, pp. 503–511*).—The results of analyses of 248 different brands of fertilizers are reported, and the composition and quality of the fertilizers offered for sale in the State during the fall of 1897 are discussed. Of the 248 brands examined 172 were complete fertilizers. In these the nitrogen varied from 0.58 to 4.89 per cent, averaging 1.69 per cent; the available phosphoric acid varied from 3.81 to 12.78 per cent, averaging 9.22 per cent; the potash varied from 0.58 to 16.52 per cent, averaging 3.92 per cent. The average amounts of nitrogen, available phosphoric acid, and potash exceeded the guaranteed average by 0.16, 0.7, and 0.18 per cent, respectively.

Analyses of commercial fertilizers, B. W. KILGORE ET AL. (*Mississippi Sta. Spec. Bul. 17, pp. 23*).—A report of analyses and valuations of 102 samples of fertilizing materials collected in Mississippi during the latter part of December, 1897, and in January, February, and March, 1898.

Results of the fertilizer control in the Baltic Provinces, 1896–97, G. THOMS (*Die Ergebnisse der Dünger-Kontrole, 1896–97. Riga, 1897, pp. 90*).—This is a reprint from *Baltischen Wochenschrift für Landwirthschaft, 1897, No. 48*, and contains reports on the importation of fertilizers into the Baltic Provinces during 1896, an account of the inspection work of the Riga Station, and a general review of literature on the quality and use of different fertilizing materials, with special applications to local conditions.

The inspection of fertilizers in 1897, F. W. MORSE (*New Hampshire Sta. Bul. 49, pp. 18*).—This is an account of the inspection of fertilizers in New Hampshire in 1897 by the Experiment Station in cooperation with the State Board of Agriculture, and includes the public statutes of New Hampshire relating to fertilizers; trade values of fertilizing ingredients for 1897; tabulated analyses of 112 different brands of mixed fertilizers and 8 samples of fertilizing chemicals, including muriate of potash, sulphate of ammonia, bone, dissolved boneblack, and tankage; a brief discussion of the price and quality of fertilizers sold in the State, and suggestions regarding the selection of fertilizers. The prices of fertilizers were lower during 1897 than they have ever been before, and the composition of mixed fertilizers generally exceeded the minimum guaranty, very few samples showing deficits in composition.

Report on the enforcement of the fertilizer control law, H. J. WATERS (*Missouri Sta. Rpt. 1897, pp. 1–9*).—Reprinted from Bulletin 34 of the station (E. S. R., 8, p. 970).

On the prevention of fraud in fertilizers and feeding stuffs, D. MOLINARI (*2 Congrès Internat. Chim. Appl., 1896, II, pp. 178–181*).

The enforcement of laws relative to repression of fraud in fertilizers, E. SILZE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 185–189*).

FIELD CROPS.

Cooperative experiments in agriculture, C. A. ZAVITZ (*Ontario Agr. and Expt. Union Rpt. 1897, pp. 13–40*).—This is a report of 18 cooperative experiments with fertilizers, fodder crops, roots, grains, grasses, and clovers carried on by 2,835 experimenters throughout Ontario in 1897. The experiments conducted at the Ontario Agricultural College (E. S. R., 9, p. 440) form the basis of the system, and varieties which have there shown themselves to be in the lead are given a further trial in cooperative tests. The results are reported in tabular form and briefly discussed.

The summary of the results of the fertilizer experiments shows that the largest average yield was produced with the use of a complete fertilizer with oats, a potassic fertilizer with corn, and a nitrogenous fertilizer with mangel-wurzels. No one variety of corn showed itself well adapted to all parts of Ontario. Cloud Early Dent has held first place in yield of whole crop for four years in succession. Grass peas were more productive and were better relished by stock when fed green than tares or crimson clover. For the production of green fodder, a mixture of 1½ bu. of oats and 1 bu. of peas and tares is recommended. This being the first year that experiments with grasses and clovers were carried on the comparative results are limited. The three varieties of buckwheat tested, Japanese, Silver Hull, and Common Gray, mentioned in the order of their productiveness, gave an average of 28 bu. per acre. Herison Bearded Spring Wheat has given the largest yield of grain per acre for four years, but this season it stood second, the Wild Goose variety giving the largest average yield of four varieties under trial in 1897. The Wild Goose Spring Wheat is considered inferior in quality. Mandscheuri Barley has given the best average yield of grain in the comparative tests and the 6-rowed varieties proved more productive than the 2-rowed and hulless varieties for six years in succession. In the comparative tests of oats during six successive years, the Siberian variety stood first in productiveness for four years but the Oderbrucker gave the largest average yield in 1896 and 1897. Among four leading varieties of peas Early Briton for two years in succession produced the largest yields. In cooperative tests of potatoes Empire State gave the best average yields for three years but fell back to third place this season. Dawson Golden Chaff Winter Wheat stood highest in productiveness for five years and was the most popular variety with the experimenters.

Experiments with cotton, J. F. DUGGAR (*Alabama College Sta. Bul. 89, pp. 24*).—This work comprises variety, fertilizer, and seed tests, and culture and distance experiments. Work along similar lines has been formerly reported (E. S. R., 9, p. 40). Of 17 well-known varieties and 15 cross bred varieties originated at the station, Texas Oak, Griffin, Hawkins, Deering, Mell Cross No. 15, Jones Reimproved, Duncan, Hutchinson, Peterkin, Truitt, and Whatley led in the increased yield of lint cotton over the check variety (Peerless). A classification of lint of the varieties grown in these experiments is given.

The results from seed of the same original stock grown for one year in different latitudes were so nearly alike that no effect could be ascribed to latitude or climate. The average results of three experiments in two years with fresh, 1-year old, and 2-year old cotton seed showed but a slight difference. The names of parties from whom cotton seed may be obtained are given.

A plat "laid by" July 26 yielded 25 lbs. of seed cotton per acre more than the average of two plats "laid by" two weeks earlier. The

increase is considered sufficient to pay for the extra cultivation. Subsoiling in January was quite beneficial to the first crop but it afforded no increase the second year.

Rows 3 ft. 4 in. apart gave practically the same yield whether the plants were 12, 18, or 24 in. apart in the row, but when the distance was increased to 30 in. the yield was noticeably reduced.

Applying 640 lbs. of slaked lime per acre broadcast showed no increase in the cotton crop that year, but the next year cotton, following cowpeas which were turned under in the spring, yielded more on the plat limed the year before than on the plat which had not been limed. A mixture of barnyard manure, cotton-seed meal, and acid phosphate was more effective when applied without composting than when composted about 1 month before using. Bedding on all the fertilizer gave better results than reserving one-fourth and applying it in the drill at planting time. An application of 150 lbs. of cotton-seed meal per acre resulted in a larger yield of seed cotton than the application of 316 lbs. of cotton seed or 70.5 lbs. nitrate of soda, these quantities furnishing equal amounts of nitrogen. Acid phosphate proved to be more effective than Florida soft phosphate except when the crude phosphate was employed in compost. A mixture of these two phosphatic fertilizers was less effective than an equal weight of acid phosphate and more effective than the same amount of Florida soft phosphate. Cotton-seed meal, acid phosphate, and kainit were applied singly and in different combinations at the rate of 200, 240, and 200 lbs. per acre respectively. The use of kainit alone was most profitable, and cotton-seed meal alone stood second. Acid phosphate applied singly gave no increase in yield. The apparent average increase in yield of seed cotton per acre due to the different fertilizers applied to plats which had received no fertilizer, or which received kainit or acid phosphate or both, was 116 lbs. for cotton-seed meal and 151 for kainit, and a decrease of 103 lbs. for acid phosphate.

Topping cotton did not prove profitable.

Red rice, W. R. DODSON (*Louisiana Stas. Bul. 50, 2. ser., pp. 208–226, pl. 1*).—A description of red rice is given and the results of experiments conducted to ascertain its origin are discussed. The flower of the rice plant and the natural provision for preserving the seed of red rice are described. The author points out the disadvantages of red rice in rice fields, considers its botanical relations, and makes suggestions how to prevent its occurrence. A test of 17 varieties of rice is reported. The experiments led to the following conclusions:

"Red rice is a different variety from the white rice. White rice will not produce red seeds when the seeds have been exposed to the weather all winter, as is commonly believed by planters. The two varieties will cross, producing hybrids, and these hybrids tend to revert to one of the parent forms, the red rice being a little stronger.

"Red rice, being dependent upon self-preservation, is hardier than the white rice

and also has a special device for preventing the seed from reaching the ground in early fall.

"The proper methods to be adopted are to use clean seed and prevent red rice from seeding after the general harvest."

Sugar-beet investigations in Wisconsin during 1897, F. W. WOLL (*Wisconsin Sta. Bul. 61, pp. 101, figs. 5*).—The work reported consisted of cooperative culture experiments made by farmers in the counties adapted to agriculture; culture tests at one or more substations in a number of counties, at each of which one-half acre of beets were grown under the direction of the station to ascertain the cost of production; a variety test; and a fertilizer experiment with sugar beets on marshy soil at the station farm. The results are tabulated and the analytical work is described. The season was not very favorable for the growth of sugar beets.

For the cooperative experiments 13,766 one-fourth pound packages of seed were sent out with complete directions for sowing, cultivating, etc. Analyses were made of 1,663 samples of beets from 68 counties, showing an average of 12.67 per cent of sugar in the juice with 74.1 as the average coefficient of purity. The average yield of beets per acre in these experiments is estimated at 12.8 tons. The richest beets were grown on the drift soils of the State. The counties located in the driftless section or sandstone section produced beets of the lowest average richness. The author states that "the sugar beet, in order to reach its highest development, requires soils rich in lime, and with us preferably such as are produced by glacial drift overlying limestone formations or produced by the decomposition of the Keweenawan or copper-bearing series (shale, conglomerate porphyry, etc.), in the extreme northwest of the State."

The relative value of beets of different degrees of purity, the importance of proper culture, and the influence of the soil are discussed. It was found that white beets are richer in sugar and have a higher coefficient of purity than red beets. Proper culture was found to be of greater importance than the use of any particular kind of standard seed. It was observed that in general beets grown after cereals were of good quality, and that beets following summer fallow were exceptionally high in sugar content and purity. A number of rotations are suggested.

The average cost of growing an acre of beets at 28 substations was $28.73 including all items from plowing the soil to storing the beets, except the cost of the seed and the rent of the land. The average yield obtained at 27 substations was 29,850 lbs. of beets per acre. Analyses were made of samples taken at the time the beets were harvested and about 1 month earlier. Forty-seven early samples from 36 substations averaged 13.49 per cent of sugar in the juice, with a purity of 80.6; while 46 samples taken at the time of harvesting averaged 15.22 per cent of sugar in the juice with a purity of 80.2.

At the station farm a 3-acre field was plowed 6 in. deep on May 7,

and the western half of the field was plowed a second time 10 in. deep and four-fifths of it subsoiled to 16 in. on May 20. The field was not particularly adapted to the sugar-beet crop, and on part of the field the crop failed. Thirteen different varieties were grown. Kleinwanzleben (seed imported from Germany) produced the highest yield on the unsubsoiled half of the field and Agnew Kleinwanzleben (a variety grown in California) on the largely subsoiled half. On the unsubsoiled half the average yield was 18,043 lbs. per acre, with an average of 13.22 per cent of sugar in the beet, while on the other half the average yield was 18,472 lbs. per acre, with an average of 14.18 per cent of sugar in the beet. The cost of growing an acre of beets in these experiments, not including the cost of seed and rent of land, was found to be $32.15.

Eight varieties were grown from high-grade seed. The sugar content in the juice ranged from 13.84 per cent in the Demesmay variety to 17.85 per cent in the High Grade Commercial Kleinwanzleben. The purity of the latter variety was the lowest, being 79.5 while that of Vilmorin La Plus Riche was highest, being 86.1. The average yield of beets per acre for all varieties was 28,103 lbs. with an average of 15.04 per cent of sugar in the beet.

Fertilizer experiments with beets were conducted on a tile drained marshy soil, and the effect of different kinds and combinations of fertilizers was compared. The average yield of beets per acre on the marshy soil was 11,774 lbs. The best results were obtained from the plat to which a mixture of double carbonate of potash and magnesia, bone superphosphate, and nitrate of soda had been applied. As a rule the beets grown on the unmanured marshy plats were not so good in quality as those grown on the 3-acre field described above.

The sugar beet in Pennslyvania, H. P. ARMSBY (*Pennsylvania Sta. Bul. 40, pp. 23*).—This bulletin contains a report on cooperative culture experiments with the sugar beet in different counties in 1897 with notes and suggestions of a general character on the beet crop, the requirements for manufacturing beet sugar, and the adaptability of the industry to the State. The results of the experiments and the meteorological data for the season are given in tables.

Of the 69 samples reported upon 55 had a sugar content of over 12 per cent in the beet and 35 a coefficient of purity above 80; 32 showed a sugar content of over 12 per cent and a coefficient of purity above 80. The average size of the beets and the yield were rather small.

Report on the results obtained with sugar cane on the experimental fields at Dodds' Reformatory, 1896, J. R. BOVELL and J. P. D'ALBUQUERQUE (*Rpt. Expt. Fields Dodds' Reform.* [*Barbados*], *1897, pp. 30*).—Work in this line has been formerly reported (E. S. R., 8, p. 394). The amount and composition of the rainfall are given in a table, and the results of experiments with manures and varieties of cane and seedling cane are reported.

Nitrogenous and phosphatic fertilizers were applied at different times and in different forms and proportions. Potash was used in the form

of sulphate and applied in varying amounts and at different times. The canes were planted on twentieth-acre plats in December, 1894, and harvested in April, 1896. The application of sulphate of ammonia, supplying 60 lbs. of nitrogen per acre, in connection with mineral manures, gave the most advantageous returns in the nitrogen series of experiments. Dried blood, up to the equivalent of 60 lbs. of nitrogen per acre, was most beneficial when applied during the earlier stages of cane growth. Sulphate of ammonia was found preferable to nitrate of soda as a source of nitrogen. The application of finely ground basic slag, furnishing 100 lbs. of phosphate per acre, applied during the early stages of cane growth, increased the yield of sugar, while the application of superphosphate caused a decrease in the yield. In the potash experiments the use of the sulphate, at the rate of 60 lbs. of potash per acre, produced the best results, and when applied in connection with nitrogen and phosphates largely increased the yield of cane and sugar.

Among the different varieties Caledonia Queen, Queensland Creole, and Seedling 7 yielded a rich juice and were free from rotten cane.

Variety tests of wheat, oats, and potatoes, G. C. WATSON and E. H. HESS (*Pennsylvania Sta. Bul. 39, pp. 15*).—This is in continuation of work previously reported (E. S. R., 9, p. 832). The variety tests were made on twentieth-acre plats. The preparation and manuring of the soil and the seeding and cultivation of all plats of the different crops were as nearly alike as possible.

Wheat.—This season 31 varieties were grown. The yield of straw followed quite closely the production of grain. The Mealy variety produced the largest yield (42.93 bu. per acre), and the Reliable Minnesota the smallest (29.49 bu.), the one producing about 45 per cent more than the other. During a six-years' test the average yield of 5 of the most productive varieties was 24.4 per cent greater than the 5 least productive varieties. Of 16 varieties tested for eight years Reliable, Fulcaster, Ontario Wonder, Wyandotte Red, and Deitz Long Berry Red, in the order given, were the most productive, the average yields being over 30 bu. per acre. The results from varieties tested two, four, and five years are given in tables.

Oats.—Seventeen varieties were grown on duplicate plats, the results for each variety being the average of 2 plats. All varieties were sown at the rate of 8 pecks per acre on April 22. Prize Taker and Everett's Superior Scotch were ripe July 17; Improved American July 26, and Brancher, Buckbee New Illinois, and Black Tartarian July 29. All other varieties ripened about July 22. Henderson Clydesdale produced the largest yield (60.94 bu. per acre), and was followed in the order mentioned by Improved American, Buckbee New Illinois, Japan, Baltic White, German White, Victoria, and Wide Awake, the latter yielding 58.09 bu.

Potatoes.—The yields of 39 varieties of potatoes tested varied from

66.3 to 221.9 bu. per acre. The time of ripening varied from ninety-five to one hundred and sixteen days. The late varieties in general were the best producers. Great Divide, Irish Daisy, New White Peach Blow, Carman No. 1, and Carman No. 3, in the order given, produced the best yields.

Manuring meadows, L. GRANDEAU (*Jour. Agr. Prat., 1 (1898), No. 13, p. 450*).—Barnyard liquor, barnyard manure, phosphoric acid, and a mixture of slag, kainit, and ammonium sulphate were applied to irrigated meadow lands. Analyses showed the soil to contain 0.182 per cent of nitrogen, 0.176 per cent of potash, and 0.095 per cent of phosphoric acid. The best results were obtained from the plat which received the mixture, the yield being at the rate of 11,657 kg. of hay per hectare. The plat which received the phosphoric acid yielded at the rate of 10,235 kg. of hay per hectare. These applications were profitable, but the barnyard liquor and barnyard manure were applied at a loss. The author recommends the use of nitrate of soda in the place of sulphate of ammonia on meadows which are not irrigated.

Alfalfa, or lucern, J. G. SMITH (*U. S. Dept. Agr., Farmers' Bul. 31, pp. 23, figs. 3*).—A revision of Farmers' Bulletin 31 of this Department (E. S. R., 7, p. 380).

Field beets, A. ARNSTADT (*Fühling's Landw. Ztg., 47 (1898), Nos. 5, pp. 183–186; 6, pp. 223–225*).—Popular directions for the culture of field beets.

Breeding forage beets, A. KIRSCHE (*Fühling's Landw. Ztg., 47 (1898), No. 7, pp. 278–280*).—Notes on the culture and breeding of beets, with results of experiments along these lines.

Investigations with forage beets, G. PATUREL (*Ann. Agron., 24 (1898), No. 3, pp. 97–133*).—A report on culture and variety tests, including the composition of forage beets.

The reproduction of beets by budding and by cutting, L. GESCHWIND (*2. Congrès. Internat. Chim. Appl., 1896, II, pp. 227–234*).—Directions for propagating beets by these methods and suggestions as to their value.

Cañaigre, F. MALET (*Bul. Dir. Agr. et Com., 2 (1897), No. 5, pp. 273–282, fig. 1*).—Notes on the culture, composition, and industrial value of cañaigre.

Carrots as a forage crop, H. L. DE VILMORIN (*Jour. Agr. Prat., 62 (1898), No. 14, pp. 501–504, pl. 1*).—Cultural notes are given and 6 varieties are described.

Cassava culture, C. K. MCQUARRIE (*Florida Farmer and Fruit Grower, n. ser., 10 (1898), No. 14, pp. 213, 214*).—Popular notes on the culture of cassava.

Experiences in the culture of corn for the grain, F. VON LOCHOW (*Mitt. Deut. Landw. Gesell., 13 (1898), No. 6, pp. 85–89*).—This article discusses the culture of corn in Germany.

Cowpeas, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circ. 5, pp. 11*).—A reprint from the Yearbook of this Department for 1896 (E. S. R., 9, p. 551).

Crimson clover, C. K. MCQUARRIE (*Texas Farm and Ranch, 16 (1897), No. 39, p. 2*).—Popular notes on growing crimson clover in the Gulf and South Atlantic States.

The effect of the direction of the rows on the yield, E. WOLLNY (*Deut. Landw. Presse, 25 (1898), No. 27, p. 277*).—The article discusses the results, which are given in tabular form. It was found that drilled crops in rows running north and south yielded more than when in rows extending from east to west.

Fertilizer experiments in 1897, F. MATHIAS (*Bul. Agr. [Brussels], 14 (1898), No. 1, pp. 15–19*).—The results of fertilizer experiments on various farm crops during each year from 1886 to 1897 are given in tables.

Notes on the application of commercial fertilizers on meadows, J. SCHMIDBERGER (*Würt. Wchnbl. Landw., 1898, No. 10, p. 134*).

Establishing and manuring meadows, TANCRÉ (*Landw. Wchnbl. Schleswig-Holstein, 48 (1898), No. 13, pp. 219–224*).—Directions for making and manuring meadows are given and grass mixtures for various soils and conditions are suggested.

Flax culture in Holland and Belgium, GISEVIUS (*Mitt. Deut. Landw. Gesell., 13 (1898), No. 7, pp. 97, 98*).—The methods of flax culture and the development of the industry are discussed.

Heine's variety tests of oats, N. WESTERMEIER (*Deut. Landw. Presse, 25 (1898), No. 22, p. 239*).

Field culture of onions, H. KOCH (*Deut. Landw. Presse, 25 (1898), No. 24, p. 263*).—A note on the culture of onions as a field crop.

Comparative tests of varieties of potatoes, N. WESTERMEIER (*Deut. Landw. Presse, 25 (1898), No. 27, p. 293*).—A report on 147 varieties.

Culture experiments of the German potato experiment station in 1897 (*Deut. Landw. Presse, 25 (1898), No. 24, pp. 261, 262*).—The starch content and the yield of tubers and starch of the different varieties are given. The plan of the cooperative experiments is outlined and the different varieties are described.

Culture of the potato, MAIZIÈRES (*L'Engrais, 13 (1898), No. 3, pp. 60–62, fig. 1*).—A popular discussion, with recommendations for increasing the yield by the use of chemical fertilizers and the selection of seed.

The sugar beet in Norway (*Bl. Zuckerrübenbau, 5 (1898), No. 6, pp. 80–90*).—Notes on sugar-beet culture in Norway and a report on the results of variety tests of sugar beets carried on at the different experiment stations.

Culture experiment with sugar beets, SCHLÜTER (*Fühling's Landw. Ztg., 47*
The culture of beets and the manufacture of sugar in Belgium, A. JADOUL
(1898), No. 6, pp. 233, 234).—The results of a test of five varieties are reported.
(*Rev. Gén. Agron. [Louvain], 7 (1898), No. 3, pp. 121–136*).

On the amount of juice in beets, H. PELLET (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 1–12*).

The German beet-sugar industry, J. GOLDSCHMIDT (*U. S. Consular Rpts., 1898, No. 211, pp. 494–500*).—The beet-sugar production of Europe in 1896–97 is reported by countries, and statistics are given to show the development of the industry in Germany. The beet-sugar legislation in Germany from 1839 to the present time is reviewed.

The soy bean in Provence, J. FARCY (*Jour. Agr. Prat., 62 (1898), No. 14, pp. 492–494, fig. 1*).—This article treats of the culture of the soy bean and of its value for forage.

Sulla and its culture, V. DE LAFFITE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 241–250*).—A description and history of sulla (*Hedysarum coronarium*), with full notes on its distribution and culture.

Silos and ensilage, M. D. ESHLEMAN (*Pacific Tree and Vine, 14 (1898), No. 47, pp. 142, 143*).—Popular notes.

Making and feeding stack silage (*Landtmannen, 8 (1897), No. 40, pp. 574–579*).

Tobacco growing, R. S. NEVILL (*Queensland Agr. Jour., 2 (1898), No. 3, pp. 173–177, figs. 2*).—Directions for the preparation of plant beds.

Cuban tobacco in Florida: How to grow it; how to cure it; how to make it pay, K. O. VARN (*Fort Meade, Fla.: The Author, 1897*).

Directions for curing heavy pipe and export tobaccos, R. S. NEVILL (*Queensland Agr. Jour., 2 (1898), No. 2, pp. 93, 94, pls. 3*).

The cultivated vetches, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circ. 6, pp. 7, figs. 4*).—Four varieties of vetches—hairy or sand vetch, winter vetch, spring vetch, and kidney vetch—are described and directions given for their cultivation, with notes on their feeding and fertilizing value.

Culture experiments with sport varieties of barley, summer wheat, and oats in 1897, N. WESTERMEIER (*Fühling's Landw. Ztg., 47 (1898), Nos. 4, pp. 150–152; 5, pp. 173–176*).—Six new varieties of barley, 7 of spring wheat, and 9 of oats were tested.

The results are given in tables and the comparative merits of different varieties pointed out.

Heine's variety tests of spring wheats, N. WESTERMEIER (*Deut. Landw. Presse, 25 (1898), No. 20, p. 219*).

Wheat growing by irrigation at Barcaldine, Queensland, W. H. CAMPBELL (*Queensland Agr. Jour., 2 (1898), No. 2, pp. 90, 91, pls. 2*).—Particulars of experiments in wheat growing by irrigation with water from artesian wells.

Medeah wheat (*Agr. Jour. Cape of Good Hope, 12 (1898), No. 5, p. 247*).—A note on the history of this variety.

Fertilizer tests with wheat, H. J. WATERS (*Missouri Sta. Rpt. 1897, pp. 9-19*).—Reprinted from Bulletin 34 of the station (E. S. R., 8, p. 973).

HORTICULTURE.

Fruit growing in Wyoming, B. C. BUFFUM (*Wyoming Sta. Bul. 34, pp. 85-157, figs. 3, pls. 36*).—This bulletin reports the results with fruits at the experimental farms of the State since the first planting in 1892. Some of the trees have begun to bear, and so indicate what may be expected, but the time since planting has been too short to allow definite conclusions to be drawn. In many cases data regarding the various varieties of fruit are given in notes and tables. In order to show what can be done in the line of fruit growing in the State and also as a matter of history, all of the fruit farms of the State, as nearly as possible, are represented in the bulletin. The illustrations are from photographs. The bulletin also includes suggestions for the culture of orchard and small fruits, irrigation, and the like.

A comparison of eastern and western grown trees resulted in favor of the latter. In 1892 146 trees of 16 varieties from New York and 52 trees of 9 varieties from Colorado were planted. Some 38 per cent of the former died the first year, as against only 17 per cent of the latter. Of 40 trees of 3 hardy varieties of apples (Ben Davis, Oldenburg, and Wealthy) obtained from New York, 32.5 per cent died the first year, while of 18 trees of the same varieties from Colorado only 17 per cent died. The eastern trees were received in better condition than the western ones.

The following varieties have proved hardy and prolific in sections representing the larger portions of the State and, excepting grapes, may be expected to succeed in sheltered localities up to an altitude of something over 7,000 feet: *Apples*—Wealthy, Oldenburg, Ben Davis; *crab apples*—Siberian, Martha, Transcendent, Hyslop; *cherries*—Rocky Mountain Dwarf, Morello, Early Richmond; *plums*—De Soto, Weaver; *blackberries*—Early King, Stone Hardy, Wilson, jr.; *dewberries*—Lucretia, Mammoth; *currants*—Red Cherry, White Grape, Crandall, Lee Prolific; *gooseberries*—Houghton, Downing; *grapes*—Concord, Wyoming Red, Delaware; *yellow raspberries*—Caroline, Golden Queen; *red raspberries*—Turner, Hansel, Thompson Early Prolific, Marlboro; *black raspberries*—Kansas, Progress, Gregg, Lovett; *strawberries*—Warfield, Bubach, Mammoth, Sharpless, Gold, Cloud, Parker Earl, Shuster Gem, Wilson, Lady Rusk, Captain Jack, Viola, Bidwell, Triumph, Crescent

Seedling, Manchester, Cumberland, Staymen No. 1, Gandy, Jucunda Improved, Lovett Early, Iowa Beauty, Eureka, Mitchell Early, Haverland, and Jessie.

The culture of native plums in the Northwest, E. S. GOFF (*Wisconsin Sta. Bul. 63, pp. 67, figs. 32*).—The native plums of the species *Prunus americana* are considered among the hardiest of tree fruits. In the winter of 1896–97, the flower buds of the trees of this species were entirely uninjured while the buds of varieties of *Prunus domestica* were almost totally destroyed. The native plums are so productive as to require thinning the fruit to prevent injury from overbearing. A figure is given illustrating the tendency to overbear, and showing the effect of thinning. In the opinion of the author the quality of the best native plums is not inferior to that of the European plums, and reports of several growers show that their market value is fully as great. The propagation, culture, insect enemies, and diseases of the native plums are considered. Notes are given on some 180 varieties of native plums. In order to ascertain the cultural methods that are practiced in the Northwest inquiries were circulated among the more successful plum growers in that region. The replies are summarized in the bulletin.

Notes on pruning, F. W. CARD (*Nebraska Sta. Bul. 50, pp. 10, figs. 2*).—An experiment was begun in the year 1895 to determine the best time to prune apple trees, the best way of making the wounds, and the best treatment of them. Two trees were pruned the first of every month of the year. A few of the wounds on each tree were left rough as made by a saw, and a few were made smooth with some cutting instrument, like the chisel. At each pruning some of the wounds, both rough and smooth, were left untreated and others were treated with the following preparations: Liquid grafting wax, shellac varnish, white-lead paint, pine tar, and coal tar. Notes are given explaining the conditions under which the various prunings were made. Observations were made on the condition of the wounds throughout the year 1895, in the spring and autumn of 1896, and in the spring of 1897.

On account of the poor condition of the trees used, it was impossible to determine definitely the most favorable season of the year for pruning. There were some indications, however, that the wounds made during the growing season healed better than when made during the winter.

As to making wounds smooth or leaving them rough there was little difference between the two methods, what there was being in favor of rough pruning. The rough wounds seemed to heal slightly better, the wood checked somewhat less, and the materials applied stayed on slightly better.

Although untreated wounds were found to heal as well as any, except those covered with wax, they checked worst of all. In regard to the various materials applied, the author says:

"Taking all things together, nothing seems to be better for covering the wounds made in pruning than common lead paint, which is closely followed by grafting wax.

The wax is superior to paint in the matter of healing, but does not last as well and is not so convenient to apply, although in warm weather, when it works well, there is little trouble in this regard. Coal tar is useful in preventing the wood from checking, but appears to be a positive hindrance to healing, so that, in spite of the fact that it stays well, there is little to recommend it. Pine tar is no aid to healing, being apparently a trifle detrimental, while it helps only slightly in the matter of checking, and does not last well, therefore it has nothing to recommend it. Shellac is a failure. It does not last and neither aids the wound in healing nor, to any appreciable extent, prevents it from checking.

Results of thinning fruit in 1897 (*Canad. Hort., 21 (1898), No. 4, p. 117*).—One tree of each variety of fruit tested was thinned and another as nearly like it as possible was left unthinned. About one-half of the fruit was removed in thinning. The apple and pear, it is thought, were thinned too late to give best results. In most cases the fruit on thinned trees was larger and better than that on the unthinned trees and in several cases the unthinned fruit was injured by rot. The results are given in the following table:

Results of thinning fruit.

Variety.	Time consumed in thinning.	Yield.	
		Thinned tree.	Unthinned tree.
Peaches:	*Hours.*	*Quarts.*	*Quarts.*
Alexander	2.00	138	114
Alexander	.50	96	42
Honest John	.25	12	12
Centennial	.25	84	60
Hale Early	1.00	111	84
Waterloo	.50	60	66
Crawford	.33	24	24
Early Rivers	.33	162	108
Apple: Spy	....	108	156
Pear: Clapp Favorite	....	132	180

Stimulating and holding fruit buds, H. E. GLAZIER (*Oklahoma Sta. Bul. 31, pp. 15–18*).—The author notes various methods of retarding the development of fruit buds of plums and reports a test of root pruning in this connection. Trees were root pruned by digging trenches about them, thus cutting the lateral roots. A treated tree was able to resist a greater degree of cold, made a greater growth the year following treatment, and produced much more fruit than an untreated one.

Strawberries and grapes, H. E. GLAZIER (*Oklahoma Sta. Bul. 31, pp. 3–11, figs. 3*).—Directions are given for the culture of strawberries in Oklahoma. Some 25 varieties of strawberries were tested, the majority of them giving good results. The dates of blooming, ripening, and first and last picking, and the yield of 19 varieties are tabulated. Brief notes are given on a number of varieties.

Grape growing in Oklahoma is discussed. A type of grape having small leaves and a tendency to deep rooting is thought best suited to the conditions of the Territory. For these reasons the Labrusca type is not well adapted to the region. A test of 175 varieties of grapes is reported. The parentage, date of ripening, color, and yield of the

varieties are given in tabular form. The author says: "In some instances the Labrusca stock has shown fairly good yields, as in the Concord and some others, but our complaint rests largely in the fault of uneven ripening, as is the case at the station."

Hybrid roses, gooseberries, and strawberries, J. L. BUDD (*Iowa Sta. Bul. 36, pp. 868–878, figs. 6*).—Brief notes are given on the most promising hybrid roses produced at the station, and on the best *Rosa rugosa* hybrids produced elsewhere and tested at the station. By way of summary the author says:

"Up to the present, our experience and observation favor the belief that the future favorite roses of the prairie States will be developed from the ironclad *Rosa rugosa* of east Europe and our native wild roses. It has been fully demonstrated that their hybrids, with our finest half-hardy varieties, follow largely the native species in hardiness of plant, perfect foliage, and complete unfolding of their flowers. It is also fully demonstrated that fine double varieties can be developed from primitive species in one generation."

Over 50 hybrids of the wild gooseberry of Manitoba, pollinated by the cultivated variety Champion, have fruited. In regard to this the author says:

"The leaves of all the hybrids are larger and thicker than those of either parent, and the fruit ranges in size on different plants from that of the Houghton to that of the Champion and Pearl. As compared with the latter sorts, the plants make fully twice as much annual growth of shoots, the leaves are larger and thicker, the thorns are stronger, but not as numerous, and the fruit has longer stems, favoring more rapid picking. . . . The great surprise of this experiment is the fact that not one of the hybrids follows the wild species in leaf, habit of growth, or fruit. The Champion pollen seems peculiarly prepotent. In all other work we have attempted in crossing on primitive forms, a large percentage of the seedlings have followed the mother very closely, often with very slight variations."

Crosses of the wild strawberry of Manitoba with pollen of cultivated varieties have not resulted satisfactorily. The author says: "We have secured the needed hardiness and perfection of leaf, but in no case have we secured the needed size for market or home use."

The cultivated species of asparagus, W. WATSON (*Gard. Chron., 3. ser., 23 (1898), Nos. 583, pp. 122–124, figs. 2; 585, pp. 147, 148, figs. 2; 587, pp. 178, 179, figs. 3*).

American ginseng: Its commercial history, protection, and cultivation, G. V. NASH (*U. S. Dept. Agr., Division of Botany Bul. 16, rev., pp. 32, figs. 5*).—This bulletin has been revised by M. G. Kains.

To keep sweet potatoes (*Queensland Agr. Jour., 2 (1898), No. 2, p. 90*).—Notes on the storing of sweet potatoes.

Observations on recent cases of mushroom poisoning in the District of Columbia, F. V. COVILLE (*U. S. Dept. Agr., Division of Botany Circ. 13, rev., pp. 24, figs. 27*).

Vegetable tests of 1897, L. R. TAFT, H. P. GLADDEN, and M. L. DEAN (*Michigan Sta. Bul. 153, pp. 230–256*).—The bulletin consists of descriptive notes and tabular data on most of the new and many of the standard varieties of beans, cucumbers, lettuce, peppers, cabbage, cauliflower, sweet corn, peas, and potatoes. The varieties that have proved most satisfactory are as follows: *Bush beans*—Cylinder Black Wax, Flageolet (?), Victoria, Golden Wax, Red Valentine, Cream Valentine, Stringless Green Pod, Byer One Bean, and Improved Goddard; *cucumbers*—Russian, Choice, Westerfield

Pickling, White Spine, and Japanese Climbing; *lettuce*—Grand Rapids, Tennis Ball, Rawson Hot House, All Seasons, Half Century, Landreth Earliest, Italian Ice, Simpson Curled, and Wonderful; *tomatoes*—Vaughan Earliest, Atlantic, Leader, Ruby, Advance, Potato-leaf Ignotum, Acme, Beauty, Ignotum, Perfection, Optimus, Golden Queen, Miner, and Ponderosa; *cabbage*—Henderson Early Summer, Wakefield, Early Drumhead, All Head, Early York, Autumn King, Lupton, Mid-Summer, Succession, and World Beater; *potatoes*—Irish Cobbler, Six Weeks, Algoma, White Ohio, Harrington Peer, Woodhull, Accidental, Uncle Sam, Klondyke, Mill Banner, Good Times, Planet jr., Sir Walter Raleigh, Carman No. 1, Carman No. 3, Enormous, Rural New Yorker No. 2, Peachblow, Livingston Banner, and Beauty of Beauties.

Livingston's celery book, E. J. HOLLISTER (*Columbus, Ohio: A. W. Livingston's Sons, 1898, pp. 96, figs. 19*).—The book contains directions for the preparation of the soil, culture, and marketing of celery, based on twenty years' experience with the crop.

Preliminary report on Arkansas seedling apples, J. T. STINSON (*Arkansas Sta. Bul. 49, pp. 20, figs. 13*).—For several years the author has been investigating the seedling apples of Arkansas origin. In this preliminary report of the investigation descriptive and historical notes are given on twenty of the most important of these seedling apples.

American apples in Belgium, H. C. MORRIS (*U. S. Consular Rpts., 1898, No. 210, pp. 131-135*).

Manual of fruit-tree culture, A. BERNE (*Manuel d'arboriculture fruitière. Montpellier: Camille Coulet; Paris: Masson et Cie., 1898, pp. 301, figs. 147*).—The book treats of soils and fertilizers for fruit trees; planting, pruning, training, varieties, and diseases of fruit trees; the picking and storage of fruit, etc. A large part of the book is devoted to the methods of pruning and training.

Damage from cold and best methods of prevention (*Florida Agr., 25, No. 18, pp. 173-175*).—This is an address by the president of the Florida State Horticultural Society on the damage of cold to orange groves and means of preventing it.

Future of some of our native fruits, nuts, and shrubs, J. L. BUDD (*Iowa State Hort. Soc. Rpt., 32 (1897), pp. 318-320*).

Winter protection of the peach, J. C. WHITTEN (*Missouri Sta. Rpt. 1897, pp. 140-159, figs. 5*).—Reprinted from Bulletin 38 of the station (E. S. R., 9, p. 835).

Cultivation and management of the peach, J. C. WHITTEN (*Missouri Sta. Rpt. 1897, pp. 159-164*).—Reprinted from Bulletin 38 of the station (E. S. R., 9, p. 837).

Cooperative experiments with small fruit, D. T. PRICE (*Mississippi Sta. Bul. 46, pp. 8*).—The bulletin gives variety tests and directions for the culture of strawberries, raspberries, blackberries, and grapes. From tests of some 50 varieties of strawberries, the author recommends the following for northeast Mississippi: Lady Thompson, Crescent, Bubach, Tennessee Prolific, Brandywine, and Lovett. Tests of a limited number of varieties of raspberries and blackberries are reported. Turner was the only red raspberry and Gregg the only black raspberry that was satisfactory. Of the blackberries tested, Dallas, Snyder, Erie, Lawton, and Taylor did well. Of the 33 varieties of grapes tested, Pocklington, Triumph, Reissling, and Moore Early proved the best.

Notes on small fruits grown in 1897, F. H. HALL (*New York State Sta. Buls. 127 and 128, popular ed., pp. 5*).—A popular edition of Bulletins 127 and 128 of the station (E. S. R., 9, p. 1052).

Raspberries, blackberries, and grapes, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Bul. 151, pp. 163-169*).—The results of tests of 40 varieties of raspberries and 19 of blackberries are given in tables and descriptive notes. Notes are also given on some 20 varieties of grapes. The following varieties of raspberries were most promising: *Black*—Palmer, Conrath, Kansas, Gregg, Older, Black Diamond, and Mills No. 15; *purple*—Shaffer, Columbian, Beckwith, and Redfield; *red*—Cuthbert, Loudon, Marlboro, Hansell, Phœnix, and Stayman No. 1.

Strawberry growing in New Hampshire, F. W. RANE (*New Hampshire Sta. Bul.

47, pp. 91–114, figs. 7).—A test of 54 varieties of strawberries is reported. A table is given showing the size and character of the foliage, the tendency to produce runners and form a matted row, and the amount of blight. The fruit of each variety is illustrated. Notes are given on 12 of the more popular varieties. The bulletin also contains directions for the culture of strawberries and notes from local strawberry growers. G. F. Beede gives a report of tests of a large number of varieties during five years. The varieties on the merits of which strawberry growers are agreed are: Bubach, Crescent, Lovett, Warfield, Greenfield, Haverland, Beverly, May King, Sharpless, Marshall, and Michel Early.

Barrel strawberry culture, J. P. OHMER (*Amer. Gard., 19 (1898), No. 172, p. 287, fig. 1*).—Directions for growing strawberries in barrels.

Report of South Haven Substation, T. T. LYON (*Michigan Sta. Bul. 152, pp. 171–229*).—The bulletin reports tests of 163 varieties of strawberries, 65 raspberries, 30 blackberries, 22 currants, 20 gooseberries, 76 cherries, 511 peaches, 148 grapes, 110 plums, 96 pears, 19 crab apples, 135 apples, and 11 quinces. The results are given in tables showing such data as dates of blooming and ripening, vigor and productiveness of plants, form, color, quality, and size of fruits, and the like, the tables being accompanied by descriptive notes. Notes are also given on dewberries, service berries, almonds, chestnuts, pecans, hazlenuts, walnuts, apricots, mulberries, nectarines, asparagus, and rhubarb.

Viticulture, P. COSTE-FLORET (*Les travaux du vignoble. Montpellier: Camille Coulet; Paris: Masson et Cie., 1898, pp. 418, figs. 121*).—The book belongs to *Bibliothèque du "Progrès Agricole et Viticole."* It treats of the propagation and culture of grapes, soils and fertilizers, insects, diseases, and the like.

The chrysanthemum: Its past, present, and future, E. M. WOOD (*Trans. Massachusetts Hort. Soc., 1897, I, pp. 28–42*).

The dahlia: A practical treatise on its habits, characteristics, cultivation, and history, L. K. PEACOCK (*Atco, N. J.: W. P. Peacock, 1896, pp. 56, figs. 11*).—The book treats of the propagation, classification, culture, and varieties of the dahlia, with chapters on dahlia exhibitions, the American Dahlia Society, etc.

The sweet pea, W. T. HUTCHINS (*Trans. Massachusetts Hort. Soc., 1897, I, pp. 46–60*).

The propagation of orchids (*Amer. Florist, 13 (1898), No. 516, pp. 1132, 1333*).

The selection of trees, shrubs, climbers, and their disposition, G. W. CARRUTHERS (*Amer. Gard., 19 (1898), No. 176, Sup., pp. 10, 11*).

Experiments in the use of commercial fertilizers (*Wiener Illus. Gart. Ztg., 23 (1898), No. 4, pp. 143–150*).—The report of the experiments of A. Hébert and G. Truffaut in the application of commercial fertilizers to various ornamental plants is translated from *Journal de la Société nationale d'horticulture de France*.

Experiments in fertilizing potted plants with nutrient salt solutions, R. OTTO (*Gartenflora, 47 (1898), No. 8, pp. 210–213, figs. 2*).—Heliotrope, pelargonium, *Fuchsia hybrida, Salvia splendens*, and *Pentstemon gentianoides* were watered with a nutrient solution at intervals of from five to eight days, being watered at other times as needed with ordinary water. The nutrient solution consisted of a mixture of 6 parts ammonium phosphate, 5 parts sodium nitrate, 5 parts potassium nitrate, and 4 parts ammonium sulphate dissolved in water at the rate of 1 part of the mixture to 1,000 parts of water. Other plants of the same kinds were watered entirely with ordinary water as a check. The plants watered with the nutrient solution were of a deeper green color than the others, had larger leaves, more numerous and generally more vigorous branches, earlier flowers, and more abundant flowers and fruit.

The horticultural directory and yearbook for 1898 (*London: Journal of Horticulture, 1898, 39 ed., pp. 480*).—The directory contains alphabetical lists of the nurserymen, seedsmen, and florists, of the gardeners, of horticultural builders, and engineers, of botanical gardens and public parks, of the seats of the nobility, and of the botanical, horticultural, and floral societies of Great Britain and Ireland; county lists of nurserymen, seedsmen, and florists in England and Wales, in Scotland, in Ireland, and in the Channel Islands, and of the seats of the nobility in Great Britain

and Ireland; lists of the principal nurserymen, seedsmen, and florists of European countries and the British colonies, of landscape gardeners, and of commission merchant and salesmen at the Covent Garden Market, London; and tables, receipts, and miscellaneous information of interest to horticulturists.

Garden making: suggestions for the utilizing of home grounds, L. H. BAILEY (*New York: The Macmillan Co., 1898, pp. 417, figs. 256*).—The book is one of the *Garden-craft series*. It contains a chapter on such topics as preparation of the land, sowing and planting, winter protection, forcing plants, insects and diseases, etc.; a chapter on the plan of the place, including discussions of the "picture in the landscape," the fundamentals of landscape gardening, specific examples, and how the improvements are made; a chapter on planting the ornamental grounds, containing a list of ornamental plants hardy in central Michigan, and remarks by Ernest Walker on plants for floral effects, flower beds, carpet-bedding, borders, annuals, bulbous and tuberous plants, hardy herbaceous perennials, climbing plants, etc.; a chapter on the fruit plantation, contributed largely by L. R. Taft, and including the grape, small fruits, northern orchard fruits, and subtropical fruits; a chapter on the vegetable garden, written in large part by F. A. Waugh; and a chapter on seasonal reminders, giving monthly calendars of garden operations for the North by T. Greiner and for the South by H. W. Smith and F. H. Burnette.

Greenhouse management, L. R. TAFT (*New York: Orange Judd Co., 1898, pp. 382, figs. 123*).—This is a manual on the forcing of flowers, vegetables, and fruits in greenhouses and on the propagation and care of house plants. Chapters are devoted to the insect enemies and fungus diseases of greenhouse plants and the preparation and use of insecticides and fungicides.

FORESTRY.

Notes on the annual growth of forest trees, W. R. LAZENBY (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 15–19*).—This is the presidential address delivered by the author at the Detroit meeting of the Society. The importance of growing forest trees and the preservation of woodlands is pointed out, and the author urges the planting of forest trees for timber, shelter, and protection, as well as for ornament and landscape effect.

A report is given on an experiment begun in the fall of 1882, in which the seeds of a dozen or more varieties of native forest trees were collected and placed under suitable conditions for planting the following spring at Columbus, Ohio. The species selected were wild black cherry, black walnut, black locust, sugar maple, catalpa, red maple, cucumber tree; white, black, and blue ash; bur, scarlet, and yellow oaks; American chestnut, Kentucky coffee tree, and beech. The seeds were planted in the spring of 1883, and, with the exception of the chestnuts, oaks, and black walnuts, all the trees were transplanted from the seed bed when a year old. The trees were grown in rows $3\frac{1}{2}$ ft. apart and 2 ft. in the row. Careful cultivation was given for the first few years until the trees had attained sufficient size to shade the ground, when no further cultivation was needed. Notes were taken from time to time on the annual growth and diameter, and the following observations were made relative to the growth of the trees:

"(1) The increase in diameter of trunk did not bear a constant ratio to the increase in height, but appeared to be mainly dependent upon the leaf development. That

is, when the plantation was thinned the trees invariably branched lower, and while making a more rapid increase in diameter made a slower upward growth.

"(2) Some species grew with great uniformity, despite the variation in season, while others presented a considerable difference from year to year. For example, the catalpa, white ash, and yellow locust represented the greatest variation in annual growth, both in height and diameter. The black cherry, black walnut, honey locust, and oaks showed the least variation. In all cases the growth was the greatest when there was the most rainfall during the growing season.

"(3) When the foliage was injured or removed early in the season, or the early growth was arrested by a severe drought, it took several years to overcome this check to normal increase, no matter how favorable the seasons were immediately following.

"(4) The greatest annual increase in diameter of trunk invariably took place in the side most fully exposed to the light, but the greatest growth in length of branches was often on the side not fully exposed. That is, although there was a greater aggregate growth of limbs and branches on the most exposed side, the greatest growth in length of single branches was frequently on the shady side.

"(5) But one so-called 'annual ring' was formed each growing season, and this was usually so well defined as to be easily counted. As a rule these rings furnish not only a convenient but reliable record of the age of trees.

"(6) The trees that made the most rapid growth were the following: Yellow locust, black cherry, catalpa, white ash, and black walnut."

The average height and diameter of ten specimens of several varieties at the end of fifteen seasons' growth are shown in the following table:

Growth of trees in fifteen seasons.

	Diameter.	Height.
	Feet.	*Feet.*
Yellow or black locust	9.0	42.00
Black cherry	7.8	38.00
Catalpa	8.2	34.00
White ash	6.1	36.75
Black walnut	6.0	35.50

The most rapid growth for any one year was made when the trees were three years old. The growth during this season was as follows: Yellow or black locust, 5 ft. 1 in.; black cherry, 4 ft. 3 in.; catalpa, 3 ft. 7 in.; white ash, 4 ft. 10 in.; and black walnut, 3 ft. 7 in.

Forestry conditions and interests of Wisconsin, F. ROTH (*U. S. Dept. Agr., Division of Forestry Bul. 16, pp. 76, pl. 1*).—This bulletin is a report, by the author, of investigations made during the summer of 1897, in cooperation with the State Geological Survey of Wisconsin. An introductory chapter is given by B. E. Fernow, chief of the division, in which the object and methods of the investigation are outlined and some conclusions and recommendations given. The inquiry was undertaken in order to ascertain definite and authoritative knowledge regarding the forest conditions of one of the most important regions of lumber production. The wooded area of this region is steadily being reduced by logging, and to some extent by clearing, and little or nothing is done either to restock or protect the cut-over lands. The present system is estimated to cause an annual loss of about 800,000,000 feet of lumber. Of the 17,000,000 acres of forest lands, more than 8,000,000

have been cut and largely burned over, so that it is said nearly one-half of the area is reduced almost to a desert condition.

The author reviews the forest conditions of the past and present, and the supplies of white, red or Norway, and jack pine, hemlock, cedar, tamarack, spruce, and balsam fir, together with hard-wood supplies. The possible rate of accretion is given, but this growth is greatly reduced by clearing, logging, and forest fires. The effect of the forest on climate and rainfall is stated. The author claims that many of the rivers heretofore navigable or furnishing a large water supply have been so reduced as to have their former utility greatly impaired. The extent and injury of forest fires in the State are mentioned, and suggestions offered for reducing them to the minimum. The forest conditions in different counties are given in some detail, together with lists of the principal forest trees of northern Wisconsin, the surface features of the State, amount of standing timber, etc.

Forest technology and uses of wood, P. RIZZI (*Tecnologia forestale ed utilizzazione dei boschi. Milan: F. Vallardi, 1897, Vol. I, pp. VII+221; 1898, Vol. II, pp. 110, ill.*).

Forest-zoological guide, C. KELLER (*Forstzoologischer excursions führer, pp. 277, figs. 78. Leipsic and Vienna: Carl Fromme, 1897; abs. in Zool. Centbl., 5 (1898), No. 4, p. 100*).—An introduction to the study of forest injuries. The subject is considered from the standpoint of leaf, bark, and wood injuries; injuries in mountains, and finally, injuries by mammals are considered. In an appendix all injuries are arranged according to the species of tree affected. The work is of value for its arrangement.

How to apply forestry in spruce lands, A. CARY (*Forester, 4 (1898), No. 3, pp. 59-61*).—The author reviews the general forest conditions of Maine and northern New Hampshire, referring particularly to the spruce timber, and gives in considerable detail the trees found on a half acre of heavy spruce timber in northern New Hampshire. He shows how that about 3,000 ft. of timber could be taken from this land, which would in no way diminish the value, but would rather improve the growth of what was left.

Wood pulp supplies and forestry, B. E. FERNOW (*Forester, 4 (1898), No. 3, pp. 52-56*).—The author in an address read before the American Paper and Pulp Association, at its meeting February, 1898, pointed out the rapid development of the paper pulp industry and the rate of consumption of timber and the possible advantage of forest management for the continued production of pulp wood.

Notes on Pinus rigida, DE LAPASSE (*Rev. Eaux et Forêts, 3. ser., 2 (1898), No. 9, pp. 291-295*).

Forest growth and sheep grazing, F. V. COVILLE (*U. S. Dept. Agr., Division of Forestry Bul. 15, pp. 54*).—This bulletin is a report of observations made regarding the effect of sheep grazing on forest growth in the Cascade Range Forest Reserve. The author concludes that sheep grazing without proper restrictions and regulations is detrimental to the reproduction of forest growth, to soil conditions, and to water-flow. Wherever forest growth is to be maintained and the washing of soils, with consequent flood dangers, avoided, the greatest care and judgment should be exercised as to the manner in which sheep grazing may be carried on without detriment.

Forest trees, H. LOUBIÉ (*Les essences forestières. Paris: Masson et Cie., 1898, pp. 191*).—Treats of the species of trees that yield resin.

The development of state forestry in Saxony, FÜRST (*Forstw. Centbl., 20 (1898), No. 4, pp. 192–197*).

Forest conservation, A. J. BOYD (*Queensland Agr. Jour., 2 (1898), No. 2, pp. 154–158, pl. 1*).

Notes on the growth of forest trees, A. HEIMERL (*Wiener Illus. Gart. Ztg., 23 (1898), No. 3, pp. 95–110, figs. 2*).

Investigations in the stand of forests, ZIELASKOWSKI (*Ztschr. Forst u. Jagdw., 30 (1898), No. 3, pp. 139–157, figs. 5*).

Report on culture experiments with Japanese, Indian, Russian, and American forest trees in Bavaria, H. MAYR (*Forstw. Centbl., 20 (1898), Nos. 3, pp. 115–131; 4, pp. 173–190, figs. 2*).

The reforestation of mountains, B. DE LA GRYE (*Rev. Eaux et Forêts, 3. ser., 37 (1898), No. 3, pp. 69–82*).

The reforestation of the Loire basin, C. BROILLIARD (*Rev. Eaux et Forêts, 3. ser., 2 (1898), No. 8, pp. 241–253*).

The fertilization of forests, A. THEZARD (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 190–226*).

Japanese and Chinese conifers, MAXWELL T. MASTERS (*Bul. Herb. Boissier, 6 (1898), No. 4, pp. 269–274*).—*Pinus scipioniformis* is described and critical notes are given of other species. A list of 34 species of coniferous trees occurring in Japan is given. The specimens determined are in the De Candolle and Boissier herbaria.

The Robinia and Sophora (*Rev. Eaux et Forêts, 3. ser., 37 (1898), No. 5, pp. 149–154*).—Notes are given on *Robinia pseudacacia* and *Sophora japonica*).

Osier culture, A. SCHMID (*Die Anpflanzung und Behandlung der Korb- und Bandweiden. Stuttgart: E. Ulmer, 1898, 2. ed., pp. 116, pls. 4, figs. 20*).

Concerning the production of the cork oak (*Jour. Soc. Agr. Brabant-Hainaut, 1897, No. 52*).

American oaks, J. HOUBA (*Bul. Soc. Cent. Forst. Belg., 5 (1898), No. 4, pp. 263–283*).

The distribution of pines in Cevennes, G. FABRE (*Rev. Eaux et Forêts, 3. ser., 37 (1898), No. 6, pp. 176–178*).

Wyoming junipers, A. NELSON (*Bot. Gaz., 25 (1898), No. 3, pp. 196–199, figs. 2*).—The relationship of the species of Juniperus is discussed and *J. knightii* n. sp. is described and figured.

Late and early frosts in their relation to forestry (*Muttrich, 30 (1898), No. 4, pp. 201–233*).

SEEDS—WEEDS.

Report of the Danish seed control for 1896–97, O. ROSTRUP (*Copenhagen: 1898, pp. 37*).—The report shows that 1,762 samples of seeds were examined from July 1, 1896, to June 30, 1897. Of this number 934 samples were from seed dealers, 69 from seed growers, 508 from farmers, and 251 samples for original investigations. Complete analyses were made of 1,184 samples, purity determinations of 243 samples, germination tests of 310 samples, and miscellaneous determinations of the remainder. A summary of the results of Danish seed analyses made during the period from 1887 to 1897, inclusive, is given.

The author states that in testing seed there are usually somewhat more hard seed in legume seed during the fall months than at sowing time in the spring. If all samples examined had been tested in the fall, the percentage of hard seed would have been as follows: For red clover, 8 per cent; white clover, 16.4 per cent; alsike clover, 4.5 per cent; black medick, 4.5 per cent; lucern, 6.2 per cent; and *Anthyllis vulneraria*, 7.1 per cent; or 1.5, 0.3, 1.0, 0.2, 1.0, and 1.1 per cent, respectively, greater than the results obtained in the spring.

The different kinds of weed seeds were determined in the seed samples and results are summarized in the report.

The author investigated the effect of concentrated sulphuric acid on "hard" seeds. It is well known that hard seed coats of wild or cultivated legumes can be prepared, both by mechanical means and by the aid of chemicals, so as to allow water to penetrate the seed coat more easily and effect germination. A sample of *Lathyrus sylvestris* seed was steeped in concentrated sulphuric acid for one minute and the germination of the seed thus treated compared with untreated seed with results as follows:

Effect of sulphuric acid on germination of Lathyrus sylvestris.

Time of germination.	Percentage of germination. With sulphuric acid.	Percentage of germination. Without sulphuric acid.
1 to 20 days	16	2
20 to 40 days	52	14
40 to 60 days	16	12
60 to 80 days	8	4
80 to 100 days	0	10
320 days	8	34
Total	100	76

The expenses of the control station during 1896–97 were 12,740.22 crowns ($4,754), covered by analysis fees received and by a Government appropriation of 5,678.47 crowns ($2,119).—F. W. WOLL.

Seed testing, C. R. BALL (*Iowa Sta. Bul. 36, pp. 856, 857*).—Brief notes are given on European seed control, the progress of seed testing in America, and seed testing in Iowa. Tables are given showing the results of two tests made at intervals of one hundred days with lettuce, parsnip, and watermelon seed. The seed was secured from five different firms, and shows quite a range in the germination of the different samples. The lettuce seed had depreciated greatly in the interval existing between the two experiments. The germinative power of the parsnip seed was slightly higher at the time of the second trial, and the watermelon seed gave a much better germination at the second testing.

Dodders infesting clover and alfalfa, L. H. DEWEY (*U. S. Dept. Agr., Division of Botany Circ. 14, pp. 7, figs. 2*).—Notes are given on the occurrence of some injurious species of dodder, methods of propagation, distribution, and suggestions for their eradication. The species in the United States which are considered injurious to economic crops are the following: Alfalfa dodder (*Cuscuta epithymum*), flax dodder (*C. epilinum*), clover dodder (*C. racemosa chiliana*), warty dodder (*C. indecora*), and field dodder (*C. arvensis*).

Massachusetts weeds, G. E. STONE (*Massachusetts State Bd. Agr. Rpt. 1897, pp. 268–277*).—A statement is given of the introduction and spread of numerous weeds, together with a list of 30 species of the worst weeds, with directions for their eradication.

Plants reputed poisonous to stock, F. M. BAILEY (*Queensland Agr. Jour., 2 (1898), No. 2, pp. 131–133, pl. 1*).—All species of the Cycadaceæ are reputed pois-

onous to stock grazing upon their herbage. *Macrozamia miquellii* is considered most injurious, as it is believed to produce in cattle a disease called "rickets." The disease causes a lack of control over the movements of the hind legs. Young stock in poor condition seem most subject to the disease. Affected animals may improve, but they are said never to completely recover.

DISEASES OF PLANTS.

The olive knot, F. T. BIOLETTI (*California Sta. Bul. 120, pp. 11, pls. 3, fig. 1, dgm. 1*).—The author reports the recent discovery in Merced County, California, of the disease known as olive knot, which is said to be caused by *Bacillus oleæ*. Attention is called to the lack of satisfactory curative measures and the importance of quarantine regulations against infected nurseries or olive groves.

This disease, which has been known for some time in Southern Europe and elsewhere, seems to be widely extended, but the specific cause was not known until 1886, when the specific organism was separated and the disease produced by means of inoculation. The disease was first noticed in the orchard referred to above in 1893 on a single tree. Since that time it has spread over a large part of the orchard. The author visited the place in February, 1898, and made a somewhat limited study of the disease. In the orchard were 141 olive trees, 6 of which have been destroyed, 43 are seriously injured, 69 show numerous knots, while the remaining 23 show little or no evidence of disease. While there is but little evidence upon which to base judgment relative to susceptibility, in this orchard some varieties seemed more resistant than others, since some were not affected, although surrounded by badly diseased trees.

The roots of the trees seemed but little affected. On the trunks, wherever there was a jagged wound, such as is made by breaking off a branch or a blow by a plow, the knots were very numerous, the edge of the wound evidently serving as a place for infection. Occasionally small tubercles, varying from the size of a pin head to that of a pea, are found on the leaves, generally on the under side. The occurrence of affected leaves is very irregular, some of the most badly affected trees showing no tubercles on the leaves. The effect on the fruit could not be definitely ascertained. The owner of the orchard stated that the fruit seemed to be affected, as many olives rotted while undergoing the process of pickling. The nature and symptoms of the disease are given at some length, largely quoted from Savastano's description.[1]

The author conducted some experiments in a laboratory with knots collected during the winter at the time of his visit, but the material was very unfavorable, most of the knots being old and dry. However, a few were found which were still unbroken, and from the interior of these cultures were made, five of which agreed morphologically with the organism to which has generally been attributed the cause of the disease.

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[1] Compt. Rend. Acad. Sci. Paris, 103 (1886), p. 1144.

In his conclusions the author states that the olive knot disease is at present limited to a very small range in California, but as it promises to be very harmful in some localities special precautions should be taken to prevent its spread. The conditions which favor the growth of the organism are delicacy of tissue owing to vigorous growth or variety, high sap pressure, wounds, and hot weather. Various precautions are suggested to be observed in pruning and caring for trees lest the disease may be spread. The author believes that olives from diseased trees are perfectly wholesome and may be used for oil purposes unless the vitality of the tree is seriously affected, but that the fruit is probably useless for pickling.

A destructive disease of maize, M. RACIBORSKI (*Ber. Deut. Bot. Gesell., 15 (1897), No. 8, pp. 475–478, fig. 1*).—The author reports the occurrence in Java of a very destructive disease of maize due to an apparently undescribed fungus, *Peronospora maydis*.

The disease attacks the young plants, the first two or three leaves appearing healthy, but the subsequent ones becoming white or very light green. Later the leaves change to such a degree that the white spots may be seen at quite a distance. The appearance of the discolored leaves is followed by the wilting and death of the plants. Examination of the diseased leaves showed the presence of a uniseptate mycelium which bears very numerous haustoria. Through the stomata appear the conidiophores, which are 3 mm. high, 25 μ in diameter, and from 3 to 6 times dichotomously branched. The conidia are spherical, 15 to 18 μ in diameter, and germinate in a few hours, producing one or more hyphæ. Culture experiments showed that the conidia when inoculated upon the leaves of maize produced the characteristic spotting within twelve to eighteen days after the first infection. The oogonia are 18 to 25 μ in diameter, with a not very thick but resistant membrane, which bears a few small, conical thickenings.

While the disease is evidently spread by the conidia being blown about by the wind, the author thinks the oospores in the soil the chief method of infection. The usual practice of alternating sugar cane and maize would tend to increase the liability to disease through the presence of innumerable oospores in the soil where the young maize plants have grown.

Thus far the disease is known only from Java, and it is thought possible that the fungus may have been introduced upon the maize from some of the native grasses. The introduction of the disease into the great maize-growing countries would be deplorable.

The diseases of the sugar cane in Java, J. H. WAKKER AND F. A. F. C. WENT (*De Ziekten van het Suikerriet op Java. Leiden: E. J. Brill, 1898, pp. 217, pls. 25*).—The authors describe, figure, and, where known, give remedial measures for the various diseases to which sugar cane in Java is subject. The diseases are grouped into four classes, those of the stalk, leaf sheath, leaf blade, and root. In addition, the gummosis of the sugar cane is discussed.

The diseases treated of are: Stalk diseases—smut (*Ustilago sacchari*), red rot (*Colletotrichum falcatum*), ananas disease or black rot (*Thielariopsis ethaceticus*), *Marasmius sacchari*, top rot, several forms of the sereh disease, and a striped disease; of the leaf sheath—eye spot (*Cercospora vaginæ*), red rot (*Sclerotium* sp.), sour rot (*Sclerotium* sp.); of the leaf blade—yellow spot (*Cercospora köpkei*), *Sclerotium* sp., rust (*Uredo kühnei*), ring spot (*Leptosphæria sacchari*), red spot (*Eriosphæria sacchari*), eye spot (*Cercospora sacchari*), leaf spot (*Pestalozzia fuscescens sacchari*), a disease causing a striped appearance of the leaves; root diseases—root rots, some of which are due to *Cladosporium javanicum* and *Allantospora radicicola*.

In addition, the authors give a list of saprophytic fungi which have been observed on the sugar cane in Java, together with technical descriptions of the following new species of fungi: *Colletotrichum falcatum*, *Thielariopsis ethaceticus*, *Hypocrea sacchari*, *Marasmius sacchari*, and *Allantospora radicicola*.

Rhizoctonia strobi, a new disease cf Pinus strobus, E. SCHOLZ (*Verhandl. K. K. Zool. Bot. Gesell. Wien*, *47* (*1897*), *No. 8*, *pp. 541–557*, *figs. 6*).—The author figures and describes a new parasite of the white pine. The attacks of the fungus were noticed in a 13-year-old mixed plantation of pines. The disease, however, seemed to be confined to the one species, although *Pinus parolinii* was abundant. Several of the trees are dead, and hundreds show the presence of the fungus. During the growing season the diseased trees appear wilted; the leaves on the lower branches become yellow or reddish in color and tend to turn downward. On the dying trees they become brown and in the later stages fall off. A changed appearance in the color of the trunks is noticed, especially near the collar of the tree. In this part of the tree an abundant mycelium is found. The fruiting bodies of the fungus have not been found.

A number of successful inoculation experiments are reported in which the fungus was transferred to some trees and the disease was developed.

But little is known about means of preventing the disease, but the fungus is thought to gain entrance primarily through the soil. The use of lime on infected soil has not given advantageous results.

The author has given the name *Rhizoctonia strobi* to the fungus.

On the viability of the winter spores of certain rust fungi, J. ERIKSSON (*K. Landt. Akad. Handl. Tidskr.*, *36* (*1897*), *No. 6*, *pp. 371–388*).—This is a report of investigations conducted by the author during the years 1895 and 1896. The main conclusions drawn from the results obtained are summarized as follows:

The winter spores of the black and crown rust fungi are viable during the spring following the fall when they formed, provided they have been outdoors during the winter, exposed to alternate frost and thaws, snow and rain.

In the open air, under the climatic conditions prevailing at Stock-

holm, Sweden, the spores germinate during the months of April and May. If the viable spores are prevented from germinating at the regular season by keeping the rusty straw dry and indoors, their viability will be preserved during the succeeding summer and fall, into the month of September or even until October.

The vitality of the spores of the black rust of oats, rye, or barley generally diminishes to such an extent that they are incapable of spreading disease after a year, whether kept in or out doors. Black rusty wheat straw seems to preserve its disease-spreading faculty somewhat longer, more than a single winter, but practically speaking may be considered almost without importance.

If the spreading of grain rust is prevented by cutting, removing, and burning black rusty straw of quick grass and other grass along ditches, etc., the work should be done either late in the fall or very early in the spring, as soon as the snow is gone, so that the spores on the rusty straw shall not succeed in germinating in April or the beginning of May, and thus contribute to the spread of disease in its immediate vicinity.—F. W. WOLL.

Annual report of the superintendent of spraying for Ontario, 1897 (*Ontario Dept. Agr., Toronto, 1898, pp. 16*).—A detailed report is given of the work conducted under the supervision of the author in spraying for the prevention of fungus diseases of orchard fruits.

In addition to spraying with fungicides for the prevention of diseases, experiments were made in spraying fruit trees while in bloom with ice water to ascertain the effect of cold rains on the fertilization of flowers and the setting of fruits, also to ascertain whether with heavy blooming the flower could not be partially sterilized in this way, thus saving the labor of thinning the fruit. Three peach trees, 3 plum trees, 3 pear trees, and 1 apple tree were selected for the work, the trees being in full bloom or just coming into bloom. Water cooled with broken ice was used, and the trees were thoroughly drenched for some time. All the trees were sprayed May 13, 14, and 15, and all except the peach trees again on May 17 and 18. The results were carefully watched, and no difference could be observed on the crop from the sprayed and unsprayed trees of the same variety, nearly 100 per cent of the blossoms setting in every case.

It would appear from the results of this experiment that cold rains during the blossoming period do not injure the blossoms unless the rains are so prolonged as to interfere with proper fertilization.

The alfalfa leaf spot disease, R. COMBS (*Iowa Sta. Bul. 36, pp. 858, 859, fig. 1*).—The author figures and describes the cause of alfalfa leaf spot (*Pseudopeziza medicaginis*). The history of the disease and estimations of the probable loss caused by it are given.

On the barberry bush as a carrier and spreader of grain rust, J. ERIKSSON (*Landtm. Manadsbl., 1897, No. 11, pp. 167-173*).

Principal results of the studies on grain rusts, J. ERIKSSON (*Rev. Gén. Bot., 10 (1898), No. 110, pp. 33-48, fig. 1*).—Essentially the same article as in Botanical

Gazette, 25 (1898), No. 1, pp. 26–28. Both are editions of the same article which has appeared in Swedish.

Notes on some diseases of trees, L. SAVASTANO (*Bol. Soc. Nat. Naples, 11 (1897), pp. 109–127*).—The author gives notes on the following diseases: Rot of Indian fig, a bacterial disease of grapes and olives, rot and gummosis of medlars, canker of poplars, the Californian disease of grapes at Sorrento, spoiling of lemons, etc.

Report on the disease of chestnuts in Limousin, Auvergne, Perigord, etc., L. CRIÉ (*Bul. [Min. Agr., France], 17 (1898), No. 1, pp. 148–161*).

A disease of chestnut trees, A. MATHEY (*Rev. Eaux et Forêts, 3. ser., 2 (1898), No. 7, pp. 226–229*).—The attack of *Agaricus melleus* and other fungi is mentioned, and the author states that much of the loss could be prevented by better attention to the trees.

Rose leaf blight, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 512, p. 951, figs. 2*).

The black speck of the rose, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 517, p. 1170, figs. 2*).—Notes are given of a disease of rose leaves due to attacks of *Pilobolus crystalinus*. Withholding manure from underneath the bushes and applications of fungicides are recommended as preventive measures.

The production of gum on cannas, M. L. LUTZ (*Bot. Gaz., 25 (1898), No. 4, pp. 280, 281*).

The lily disease (*Florists' Exchange, 10 (1898), No. 16, p. 407*).—The author maintains that *Lilium harrisii* will not stand overwatering or other injury, the disease quickly following such treatment.

Diseases of variegated plants, B. D. HALSTED (*American Florist, 13 (1898), No. 515, p. 1106, fig. 1*).—The author claims that the variegation lessens the ability to resist fungus attacks.

A disease of Pinus monticola, J. LAURIE (*Gard. Chron., 3. ser., 23 (1898), No. 591, p. 244*).—Reports a disease of this American pine. It proved to be caused by *Peridermium pini*.

A new leaf disease of coffee, P. HENNINGS (*Ztschr. Trop. Landw., 1 (1897), No. 8; abs. in Bot. Centbl., 73 (1898), No. 11, p. 410*).—Notes are given on *Hemileia woodii*, a new fungus enemy of coffee in German East Africa.

Etiology of "Malsania" of Corylus avellana, U. BRIZI (*Atti R. Accad. Lincei, Rend., 6 (1897), II, pp. 227–231*).

Notes on Sporotrichum globuliferum, TRABUT (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 4, pp. 359, 360*).

Note on the distribution of Pseudocommis vitis, M. BÉLÈZE (*Bul. Soc. Mycol. France, 14 (1898), No. 1, p. 27*).—Notes its occurrence in Scabiosa, Rumex, Teucrium, Acer, Glechoma, Verbena, Viola, etc.

On the rôle of Pseudocommis vitis in the bulb disease of Crocus and diseases of the chestnut and palm, E. ROSE (*Bul. Soc. Mycol. France, 14 (1898), No. 1, pp. 28–36*).

Concerning Exobasidium vitis on grapes, V. PEGLION (*Bol. Ent. Agr. e Patol., 4 (1897), pp. 302–304*).

The grape oïdium, L. DEGRULLY (*Prog. Agr. et Vit., 29 (1898), No. 14, pp. 417, 418, pl. 1*).

Influence of fertilizers on the diseases and injuries of grapes, P. COSTE-FLORET (*Prog. Agr. et Vit., 29 (1898), No. 12, pp. 363–372*).

Concerning the diseases of grapes in Baden during 1897, E. BEINLING (*Wchnbl. Landw. Ver. Baden (1898), Nos. 6, pp. 68, 69; 7, pp. 83–85*).

What is the proper scientific name for black rot of grapes? E. ROSE (*Bul. Soc. Mycol. France, 14 (1898), No. 1, pp. 24–26*).—An extensive synonymy is given, from which the author concludes the name should be *Guignardia ampelicida*, as that name antedates all others by more than 12 years.

The black rot of grapes, A. PRUNET (*Prog. Agr. et Vit., 29 (1898), No. 14, pp. 426–433*).—A report made to the Congress of Viticulturists.

The black rot in Aveyron in 1897, E. MARRE (*Prog. Agr. et Vit., 29 (1898) No. 17, pp. 531–535*).

On the treatment of black rot, G. HÉRON (*Prog. Agr. et Vit., 29 (1898), No. 17, pp. 528–531*).

On the use of corrosive sublimate for the prevention of grape disease, A. CHEVALLIER (*Prog. Agr. et Vit., 29 (1898), No. 14, pp. 420, 421*).

On the treatment of pourriture grise, L. DEGRULLY (*Prog. Agr. et Vit., 29 (1898), No. 16, p. 483*).—A powder, consisting of steatite 92 per cent, sulphate of alumina 3 per cent, sulphate of lime 4 per cent, and sulphate of iron 1 per cent is described.

Concerning a corrosive sublimate fungicide, L. DEGRULLY (*Prog. Agr. et Vit., 29 (1898), No. 16, pp. 481–483*).—A fungicide, consisting practically of 100 liters of water, 20 kg. salt, and 5 kg. corrosive sublimate, was sold in France during the past year at an extravagant price. Allowing for the market price of the salt and mercury, it is said that the water sold at 1.17 francs per liter. The extravagant claims for the fungicide are not substantiated, although it has considerable merit. It was sold under the name "Liqueur antiseptique agricole."

Preparation and application of fungicides, W. C. STURGIS (*Connecticut State Sta. Bul. 125, pp. 16, figs. 10*).—Directions are given for the preparation and application of the following fungicides: Copper-sulphate solution, Bordeaux mixture, Bordeaux mixture and Paris green, ammoniacal solution of copper carbonate, potassium sulphid, corrosive sublimate, and formalin. Various kinds of spraying apparatus are figured and described, the cost of the materials is given, and brief notes on when to spray.

ENTOMOLOGY.

Proceedings of the ninth annual meeting of the Association of Economic Entomologists (*U. S. Dept. Agr., Division of Entomology Bul. No. 9, n. ser., pp. 87*).—The proceedings of the convention held at Detroit, August 12 and 13, 1897.

The present and future of applied entomology in America, F. M. Webster (pp. 5–15).—The presidential address, consisting of general remarks on the value of the meetings of the association, the work and position of the entomologist, and his relations to politics, etc.

Additional observations on the parasites of Orgyia leucostigma, L. O. Howard (pp. 15–18).—These observations are in addition to those previously published by the author (E. S. R., 9, p. 258). From 5,000 larvæ and pupæ of *Orgyia leucostigma*, collected in July, 1897, there issued the following species of parasites: *Tachina mella*, 220; *Frontina frenchii*, 355; *Euphorocera claripennis*, 464; *Exorista* sp., 13; *Helicobia helicis*, 4; *Phorocera* sp., 45; *Chalcis ovata*, 551; *Apanteles parorgyiæ*, 3; *Dibrachys boucheanus*, 10; total, 1,665. From the cocoons, 321 male moths and 764 female moths were obtained. One hundred and forty-six of the caterpillars or chrysalids died from a disease that the author calls black rot and 33 from another disease that he calls red rot. In percentages the results were as follows: Moths, 21.07; dipterous parasites, 22.02; hymenopterous parasites, 11.02; disease, 3.58; total, 57.69. This leaves about 2,000 chrysalids that died from some unknown cause. The mortality ratio was 79 as contrasted with 98.2 per cent at a corresponding time in 1896.

Temperature experiments as affecting received ideas on the hibernation of injurious insects, *L. O. Howard* (pp. 18–20).—According to the result of experiments extending over a period of two years a change from a temperature of about 18° F. to one of 40 or 50° and then back again to a lower temperature, is fatal.

Notes on certain species of Coleoptera that attack useful plants, *F. H. Chittenden* (pp. 20–25).—The following insects are noted: *Orsodachna atra*, on pear and cherry; grapevine colaspis (*Colaspis brunnea*), which has been found on beans, clover, Le Conte pears, potatoes, corn, tick trefoil, and the New Jersey tea plant (*Ceanothus americanus*); horse-radish flea-beetle (*Phyllotreta armoraciæ*), which has been taken in Wisconsin and may travel eastward; *Psylliodes punctulata*, which is found on rhubarb in the District of Columbia; corn and grass feeding Chætocnemas (*Chætocnema pulicaria*, *C. confinis*, and *C. parcepunctata*), which have been found upon corn and *C. denticulata* in Maryland on barnyard grass; the locust leaf miner (*Odontota dorsalis*), the range of plants liable to be attacked by which seems large and which has been found feeding on red clover under locust trees, and also on the hog peanut (*Falcata comosa*); *Chelymorpha argus*, found on the sweet potato; *Epicauta trichrus*, also found on the sweet potato and on hedge bindweed (*Convolvulus sepium*), and in Illinois on the may weed (*Maruta* [*Anthemia*] *cotula*); false rose chafer (*Macrodactylus angustatus*), which seems to prefer the black or sour gum (*Nyssa multiflora*), chestnut (*Castanea dentata*), oak, particularly chestnut oak (*Quercus prinus* et al.) and sassafras, and has also been beaten from dogwood, hickory, and persimmon, but the leaves of these did not appear to be fed upon to any noticeable extent; and the potato-bud weevil (*Anthonomus nigrinus*), found on the eggplant in Maryland.

An experience with Paris green, *T. D. A. Cockerell* (p. 25).—The author notes that in the case of an application of Paris green to the peach, as a remedy against *Allorhina mutabilis*, the poison which entered over-ripe peaches passed into the circulation of the tree so as to affect neighboring branches injuriously.

The present status of the San José scale in Michigan, *W. B. Barrows* (pp. 27–30).—The scale occurs in the State in thirteen different localities. The introduction of the scale into Ottawa County is traced to stock received from New Jersey in 1890. As it winters in Ingham and Ottawa counties, it is thought very likely it will winter safely further north.

Vernacular names of insects, *C. P. Gillette* (pp. 32–34).—A list of common names is given with a view to improvement in orthography.

Notes on Cape of Good Hope insects, *C. P. Lounsbury* (pp. 34–38).—Among the insects noted as injurious in South Africa is the red-winged locust (*Acridium purpuriferarum*), which has decreased in numbers from attacks of a fungus disease identified with *Empusa grylli*. Artificial propagation of the disease was tried, but owing to

unfavorable meteorological conditions was found to be a failure in most cases. The author also notes as injurious a pyralid moth (*Loxostege frustalis*), the peach maggot (*Ceratitis capitata*), a serious pest from a horticultural standpoint, attacking peaches, nectarines, guavas, oranges, and loquats; and the red scale (*Aspidiotus aurantii*), one of the worst foes of citrus growers, which was very injurious in nearly all parts of the colony last year. The scale has no important insect foes or enemies in the colony; the small ladybirds attacking it have little effect and the imported species, with the exception of one (*Orcus australasiæ*) have not survived. Fumigation has been successful. The ptinid beetle (*Sitodrepa panicea*) was found attacking leather and binding of documents in colonial archives. *Phylloxera vastatrix* seems to be increasing, but so far as known no leaf-infesting form appears in that region.

A useful American scale insect, L. O. Howard (pp. 38–40).—It is noted that there occurs in the southwestern part of the United States, on the creosote bush, a light insect (*Cerococcus quercus*) that seems important on account of its commercial possibilities. Other species of the genus found in North America noted are *Tachardia mexicana*, *T. gemmifera*, *T. pustulata*, *T. fulgens*, and *T. cornuta*. The commercial importance of the Chinese and Japanese *Ericerus pé-la* and the Indian *Ceroplastes ceriferus* has already been established, and the species (*C. floridensis*) occurring in the South in the gall berry deserves notice as does also *Cerococcus quercus*, which has been recorded as feeding on *Quercus oblongifolia*, *Q. undulata*, and *Q. agrifolia*. Remarks are made on the chemical character of the wax secreted by this insect.

Insects of the year in Ohio, F. M. Webster and C. W. Mally (pp. 40–46).—Besides the periodical cicada (*Cicada septendecim*) and the chinch bug (*Blissus leucopterus*), there are noted the San José scale (*Aspidiotus perniciosus*), oyster-shell bark louse (*Mytilaspis pomorum*), Colorado potato beetle (*Doryphora 10-lineata*), asparagus beetle (*Crioceris asparagi*), cankerworm (*Anisopteryx vernata*), bollworm (*Heliothis armiger*), *Brachyrhynchus granulatus*, *Coriscus ferus* on *Leptoterna dolobrata* tarnished plant bug (*Lygus pratensis*), bagworm (*Thridopteryx ephemeræformis*) from which a tachinid (*Sturmia distincta*) was bred; common mealy bug (*Dactylopius adonidum*), which was observed to be preyed upon by the slug *Limax campestris; Allorhina nitida*, usually not abundant in Ohio, but reported as doing considerable injury in 1896 to tomatoes in the southern part of the State, also as being very abundant this year in the central part of the State; the tachinid (*Euphorocera claripennis*), which was reared from the larva of *Cœlodasys unicornis; Conotrachelus nenuphar*, from which four samples of *Sigalphus curculionis* were reared; an unknown species of Tyroglyphus found affecting walnuts and chestnuts; larvæ of *Papilio troilus*, the time of the emergence of the imago of which is noted; larvæ of *Onectra distincta*, which during the present year did considerable damage to young plums,

grapes, and nursery rows at Troy; *Oberea bimaculata*, a larva of which was found boring in an apple twig and its method of work noted; *Hamamelis virginiana*, the larvæ of which were found similarly boring in a twig of witch-hazel; *Conotrachelus posticatus*, which was reared in great numbers from a lot of acorns of *Quercus alba;* and the grape-root worm (*Fidia viticida*), still a pest in the vineyards along Lake Erie, notwithstanding the increased numbers of parasites. An experiment with tobacco dust and kainit as remedies against this pest is noted, which showed that the kainit can scarcely be applied strong enough to be effectual.

On the preparation and use of arsenate of lead, *A. H. Kirkland* (pp. 46–49).—To make 10 lbs. of arsenate of lead in 150 gal. of water, as used in the work against the gypsy moth, there is required about 13 lbs. $2\frac{1}{5}$ oz. of acetate of lead and 5 lbs. $7\frac{2}{3}$ oz. of arsenate of soda. The relative amounts of these two salts must be governed by their purity. The best results are obtained by preparing the poison according to the method described in the paper read by the author at the last meeting (E. S. R., 9, p. 660). The method of weighing the salts in connection with the gypsy moth work is noted. The cost of the lead mixtures is about $6\frac{1}{2}$ cts. per pound, exclusive of freight, labor, boxing, etc., which latter factors it is thought should not increase the cost over $\frac{1}{2}$ ct. a pound. A 25-gal. galvanized iron tank has been found more convenient in woodlands than a larger one. To prevent clogging a strainer of wire gauze with 70 meshes to the inch is used, and for the same purpose a wire gauze strainer is inserted in the nozzle of the spraying apparatus. Arsenate of lead when applied to foliage in the form of a spray is shown to be very permanent. Even in unfavorable weather from 60 to 80 per cent of larvæ are destroyed. Three to four pounds of the mixture are equal in effect to 1 lb. of Paris green, but it is nevertheless a cheaper remedy. Another arsenate of lead, the diplumbic arsenate, has been prepared from nitrate of lead and arsenate of soda at a somewhat smaller cost than that noted for the arsenate of lead.

Notes on the malodorous carabid, Nomius pygmæus, *W. B. Barrows* (pp. 49–53).—A very offensive odor was traced to this beetle.

Notes on insecticides, *C. L. Marlatt* (pp. 54–63).—Soaps, resin washes and compounds, pure kerosene, kerosene emulsion; the lime, salt, and sulphur wash; hydrocyanic-acid gas, steam and superheated water, arsenicals, and lime are discussed. No more unsatisfactory material for work against insects can be found than soft soap. The formulas often given are criticised as calling for too large an amount of water. Experiments have shown that an addition of 1 oz. of lime for each quart of diluted soap will render soap fluid when cold, even when in strong solution. Experiments in making a soap with potassium hydrate and oil are mentioned. For trees five years old and under 1 gal. of resin wash is thought sufficient per tree, while for trees twenty to thirty years old 6 or 8 gals. may be necessary. Several formulas are

mentioned. The objection is raised to the Webber and Swingle formula that there is a large amount of sediment. Pure kerosene was used on different trees without ill effects. The soil was mounded up at the base of the young trees to prevent the oil collecting at that point. On one large peach tree sprayed at least 99 per cent of the scales were killed. The remainder were protected by masses of leaves about the limbs. Identical results were obtained in spraying Euonymus. The experiments were performed when the trees were dormant. A manufacturing plant for kerosene emulsion in California is noted where the emulsion is made at a cost of 13 cts. per gallon in the undiluted state. When diluted the cost is a little over 1½ cts. per gallon.

The lime, salt, and sulphur wash seems to be less effective in northern California, where moist conditions prevail. Successful experiments are noted with hydrocyanic-acid gas on trees on the grounds of the Department of Agriculture.

Experiments with formic aldehyde gas produced no results. It is not worth considering in comparison with hydrocyanic-acid gas.

The bean leaf beetle, F. H. Chittenden (pp. 64–71).—It is noted that *Cerotoma trifurcata* has been found on beans in portions of Maryland and Virginia, and it is thought probable that the species is on the increase. A brief account of the literature is given, and of the insect's occurrence in 1897. The insect in its different stages is described. Its distribution is given from Canada southward to the Gulf States and westward to Kansas and Minnesota. It has been found attacking tick trefoil, hog peanuts, cowpeas, and beans. The beetles attack plants somewhat differently, sometimes attacking the edges of the leaves, as in the case of the hog peanut, sometimes even consuming the mid-rib. In the case of the bean and the cowpea they form large round holes in the leaves. As they feed on the under surface of the leaves and are at rest during the greater portion of the day they seldom attract attention; but on wild plants they are found in the center of the upper surface near the tops. The nature of their work is somewhat similar to that of the grapevine colaspis. The eggs are laid around the stem of the plant in clusters of from 6 to 10 and the larvæ attack the plants at this point. In Minnesota the first generation is said to feed on beans and the second on cowpeas. In the District of Columbia it is thought that the period of egg deposition extends from the middle of May through June, and that the entire life cycle probably requires six to nine weeks. Spraying with arsenicals and clean culture are advised.

Notes on Anarsia lineatella, A. B. Cordley (pp 71–75).—The work of this insect in Oregon on peach and prune trees and strawberry plants is discussed. It is thought that two species must be involved in the description of *Anarsia lineatella*, or else a dimorphism due to food plants and seasons exists. One of the species it is thought feeds normally on strawberry plants, the other upon trees of the genus Prunus. It is thought that possibly one may be *Anarsia prunus*.

A successful lantern trap, C. P. Gillette (pp 75, 76).—There is here described an apparatus of tin consisting of 3 pieces—a funnel 22 in. in diameter and 20 in. high, with a stem 2½ in. in diameter which fits inside the neck of a reservoir which has a removable bottom. In the reservoir, which is 5 in. in diameter, is placed a quantity of excelsior and a 3-oz. wide-mouth cyanid bottle. In one night before 12 o'clock as many as 2,000 moths and 3,000 beetles, besides other insects, were taken in one of these traps hung under an electric light, and the majority of the specimens were uninjured.

Oviposition in young forest trees by Tetraopes femoratus, C. P. Gillette (pp. 76, 77).—The method of egg deposition by this insect, as observed by the author, is described. The insect, as watched, occupied one minute in cutting a cross slit and about nine minutes in depositing her eggs in it. Four such cuts were found on one petiole. Three contained two eggs each, the other, one. The insect does not confine its attacks to the soft maple nor to the petioles of leaves.

A few insects that have been unusually abundant in Colorado this year, C. P. Gillette (pp. 77–79).—There are noted the peach-twig borer (*Anarsia lineatella*),which probably reached Colorado from California; *Haltica punctipennis*, found abundant on grapevines and the red raspberry and to some extent on strawberry plants, and plant lice (*Hyalopterus pruni*, etc.), against which whale-oil soap in the proportion of 1 lb. to 8 gal. of water was found more effective than the ordinary kerosene emulsion. *Schizoneura americana* seems to be greatly increasing in Colorado. It begins its attacks at the opening of the first buds, and when the clusters of leaves reach a diameter of 3 to 5 in. they die and the lice migrate to other leaves, which they cause to turn yellow or reddish and to roll. This species has been severely attacked by the larvæ of *Syrphus americanus*. Another syrphid (*Eupeodes volucris*) was very destructive to *Hippodamia convergens*, more so than the common ladybird.

Notes on insects of Norway and Sweden, W. M. Schöyen (pp. 79, 80).—The following common pests are noted: *Agriotes obscurus* and *Diacanthus æneus, Agriotes lineatus, Oscinis frit, Chlorops pumilionis* (*tæniopus*), *Cecidomyia destructor, Phyllopertha horticola, Oligotrophus alopecuri, Cleigastra* (*armillata?*), *Diacanthus æneus, Tipula oleracea, Anthomyia brassicæ, Silpha opaca, Pieris brassicæ, Meligethes æneus, Psila rosæ, Tipula oleracea, Syromastes marginatus, Cetonia metallica, Adimonia tanaceti, Anthonomus pomorum, Carpocapsa pomonella, Phyllobius pyri, Phyllopertha horticola, Psylla mali, Aphis mali, Telephorus obscurus, Phytoptus pyri, Nematus ribesii* (*ventricosus*), *Zophodia convolutella, Typhlocyba rosæ, Aphis rosæ, Tetranychus telarius, Hylurgus piniperda, Lophyrus rufus, Bupalus piniarius, Cecidomyia brachyntera, Tetranychus* sp., *Orgyia antiqua, Bombyx rubi, Hyponomeuta variabilis, H. padi*, and *Apoderus coryli*.

Notes from Maryland on the principal injurious insects of the year, W. G. Johnson (pp. 80–82).—The following insects are noted: *Phyto-*

nomus punctatus, *Chætocnema pulicaria*, *Epitrix cucumeris*, *E. parvula*, *Trichobaris trinotata*, *Sphinx* (*Protoparce*) *carolina*, *Aphis gossypii*, *A. brassicæ*, *A. persicæ-niger*, *Myzus cerasi*, *Diabrotica vitata*, *Murgantia histrionica*, *Anthonomus signatus*, *Graphops marcassitus*, *Typophorus* (*Paria*) *canellus*, *Conotrachelus nenuphar*, and *Diplosis pyrivora*. In the comments on the San José scale (*Aspidiotus perniciosus*) it is noted that in an orchard containing 28,311 trees 13,000 are now dead or dying. The partially mature insect has been found in large clusters on crab grass (*Panicum sanguinale*).

Notes on some little-known insects of economic importance, *W. G. Johnson* (pp. 83–85).—The following are noted: *Hydræcia marginidens*, found boring into the main stems and larger branches of cosmos plants; *Pyrausta ferrugalis*, found injuring young tender lower leaves of tobacco in a hotbed; *Uranotes melinus*, found on beans; *Cerotoma trifurcata* (*C. caminea*), observed in a patch of wax and Lima beans; *Crambus caliginosellus*, which was very destructive during 1897 to young corn in several counties; *Tribolium madens*, found in mill products sent from the State of Washington; and *Aspidiotus forbesi*, which during the season has been found very abundant on young apple, pear, and cherry trees.

A list of the members of the association is appended.

Revision of the Tachinidæ of America north of Mexico, D. W. COQUILLETT (*U. S. Dept. Agr., Division of Entomology Bul. 7, tech. ser., pp. 154*).—This, a purely technical toxinomic monograph, is so arranged as to be of great use to the student. The economic importance and the habits of the group are very briefly noted, and the 98 species of parasites, arranged alphabetically in connection with their proper hosts, are listed. This is followed by a list of the 169 hosts in alphabetical order, with mention of the species of the group parasitic upon them. The orders of the class Insecta are attacked in the proportions shown by the following figures: Hymenoptera, 12; Hemiptera, 1; Orthoptera, 4; Coleoptera, 17; and Lepidoptera, 136. *Leucania unipuncta* and *Orgyia leucostigma*, each with 7 species of parasites, are the two forms most severely attacked.

Following these lists is a brief explanation of the classification and of the terms employed. A long table of genera and a list of 34 unrecognized genera are given, introductory to the systematic arrangement of the genera and the description of species.

On the biology of Ocneria dispar in Russia, N. KULAGIN (*Illus. Wchenschr. Ent., 2 (1897), No. 27, pp. 418–420*).—This pest appeared in great numbers in the government of Kostroma in 1895 and 1896. In 1894 and 1895 it appeared in great numbers along with *Ocneria monacha* in central Russia. The period of devastation generally lasted about three years, but in the region of Moscow it lasted four years (1893–1896). In 1895–96 in the government of Nijninovgorod the moths appeared from July 8 to 18.

It was found that the eggs would stand a temperature of 40° R.

(122° F.), but when deprived of their covering were killed by 15° R. The larvæ appeared at the beginning of May and molted five times before pupation. Pupation occurred at Moscow July 2.

In some places in Vovonesch 20 per cent of the young eggs were killed. In many places the insects were severely parasitized. In Vladimir 40 per cent of the pupæ were so affected; in Moscow in 1895 20 per cent and in 1896 57 to 60 per cent. In Vovonesch in 1894 70 to 80 per cent were parasitized. In Moscow the parasites were mostly flies. At one place near Moscow 1½ to 2 pud (49 to 72 lbs.) of eggs were collected from one hectare. In Vladimir 76 pud (2,741 lbs.) were collected from 6,000 hectares (14,830 acres).

A remedy for trial in the destruction of the worm of the vine (Cochylis), J. DUFOUR (*Chron. Agr. Cant. Vaud, 10 (1897), No. 8, pp. 216–220*).—After mentioning the commonly used pyrethrum and the fluctuations in the supply of the same, the author considers the substitution of terebinthin for pyrethrum in mixtures. It is sufficient to dissolve 3 kilos of black soap in several liters of warm water, afterwards adding thereto cold water to make 100 liters, finally adding 2 liters of the essence of terebinthin. These 102 liters of solution will cost about 3½ francs—less by half than the cost of the pyrethrum. It is important that not more than 2 per cent of the terebinthin should be employed, lest it damage the grapes.

The following experiments are noted: (1) Soap, 2 per cent; terebinthin, 1 per cent. Worms treated by plunging bunches of grapes rapidly into the solution. Of 21 worms, 3 were killed, 3 injured. (2) Same solution with the addition of colophane. Of 8 worms, 3 were killed, 2 injured. (3) Black soap 3 per cent, terebinthin 2 per cent. Of 64 worms, 44 were killed and 10 injured. (4) Black soap 3 per cent, sulphurous terebinthin 2 per cent. Of 16 worms, 11 were killed. (5) Black soap 3 per cent, terebinthin 1 per cent, oil of colza 1 per cent. Of 33 worms, 20 were killed and 5 injured. Analogous results were obtained by replacing the terebinthin with benzin. (6) Soda, 3 per cent; terebinthin, 2 per cent, with and without the addition of blue vitriol 2 per cent. Many worms killed but grapes greatly damaged. (7) Black soap, 3 per cent; terebinthin, 3 per cent. Of 24 worms, 18 were killed and 5 injured. This last solution, it is noted, burned the grape bunches, the parts most sensitive to its action being not the flower but the small pedicel that supports it. A similar effect follows the use of the 2 per cent solution in a very slight degree, but this, it is thought, is greatly counterbalanced by the worms killed.

Contributions from the New Mexico Biological Station, No. 2, on the collection of Diptera from the lowlands of Rio Nautla, in the State of Vera Cruz, II, C. H. T. TOWNSEND (*Ann. Mag. Nat. Hist., 6. ser., 20 (1897), 115, pp. 19–33*).—A new Psychodid (*Psychoda punctatella*), a new Tabanid, several Syrphids, and two new Phasiids are described. The distinctive features of *Tabanus mexicanus* and varieties are brought out tabularly, as are also the characters of several forms of the Syrphid genus Nausigaster. The author is confident that several species of this genus occur in North America, and three of them are described by Williston under the name of

Nausigaster punctulata. The author distinguishes the species from *N. punctulata* as follows:

(1) (*a*) A single spot on the wings; 5 thoracic vittæ; from California; *N. unimaculata* n. sp. (*b*) Spots on wings; the spots not confluent; only 2 thoracic vittæ; from New Mexico; *N. punctulata*, Will.

(2) The 2 wing spots confluent, forming a more or less well-defined and extensive picture, the basal cell mostly filled with the picture; 4 thoracic vittæ; habitat, Lowlands of Texas to Brazil; *N. meridionalis*, Towns.

(3) The second basal cell almost wholly hyaline. From the Texas lowlands; *N. germinata* n. sp.

Five new species of Volucella are distinguished from one another and Williston's Chætophora in the same manner. *Viridana* n. sp., is distinguished by the occurrence of a prescutal row of bristles; its bright marked, green scutellum and copper abdomen; Chætophora by its hyaline wings with only a milk tinge in oblique lights; *Opalina* n. sp., by its metallic scutellum, which resembles the abdomen in color; the absence of stripes on the face and cheeks and of yellow on the abdomen, and by its wings being strongly shaded with brown; *Raphalana* n. sp., by its striped face and cheeks; *Codiæ* n. sp., by its brown yellow scutellum, the second abdominal segment resembling it and the rest of the abdomen being yellow; *Nautlana* n. sp., by its second and third abdominal segments being of the same color as the scutellum, by a nearly equal subtriangular patch on the anterior corners, and by a similar easily distinguishable patch on the anterior corners of the fourth segment.

Report of the State entomologist for 1897, W. M. SCHÖYEN (*Christiania, 1898, pp. 45, ill.*).

Contribution to the knowledge of some of the gall-making insects of Vallombrosa, G. CECCONI (*Malpigia, 9 (1897), pp. 433–457*).

Ants' nests, A. FOREL (*Internat. Jour. Micros. and Nat. Sci., 3. ser., 7 (1897), No. 36, pp. 347–381, pls. 2*).—This is a translation of the author's "Die Nester der Ameisen" published at Zurich in 1893, and is an interesting discussion of the various forms of nests, the operation of building them, and other collateral questions such as symbiosis, the kindred relations between ants and plants, nests of mixed colonies, migratory nests, road building, etc.

On the attraction of flowers for insects, J. LUBBOCK (*Jour. Linn. Soc. Bot. London, 33 (1898), No. 231, pp. 270–278*).—From the results of a series of tests the author maintains that both color and scent are instrumental in guiding and attracting honey bees. The experiments of Plateau are said to be inconclusive, many of them being conducted upon mutilated flowers with no checks. The author placed drops of honey on the bright blue bracts of *Eryngium amethystinum* as well as on the flowers, and both were visited indiscriminately. Solutions of sugar and saccharine were placed near by, and the first was visited, while the other did not attract a visitor.

The San José scale, H. OSBORN (*Iowa Sta. Bul. 36, pp. 860–864, figs. 3*).—As this insect does not occur in Iowa, this article, which is a brief popular account of it, the plants that attract it, etc., is intended as a warning notice to those concerned.

The woolly aphis of the apple, J. M. STEDMAN (*Missouri Sta. Rpt. 1897, pp. 36–61, figs. 6*).—A reprint of Bulletin 35 of the station (E. S. R., 9, p. 155).

The lesser apple leaf folder and the leaf crumpler, J. M. STEDMAN (*Missouri Sta. Rpt. 1897, pp. 62–80, figs. 6*).—A reprint of Bulletin 36 of the station (E. S. R., 9, p. 157).

Insect enemies of the locust, A. D. HOPKINS (*West Virginia Farm Review, 6 (1898), No. 3, pp. 88–93, figs. 6*).—The author gives a popular description of and figures 3 principal enemies of this tree, namely, the locust leaf beetle, locust tree borer, and the carpenter worm. The unhealthy condition of the yellow and black locusts in the State has within recent years attracted considerable attention.

Termites, B. GRASSI and A. SANDIAS (*Quart. Jour. Micros. Sci. [London], n. ser., 40 (1897), 1, pp. 1–75; abs. in Jour. Roy. Micros. Soc. [London], 1897, No. 5, pp. 370–372*).—

This is a translation by W. H. F. Blanford of Grassi's Italian memoir on the constitution and development of termite societies. The memoir is the result of a long series of observations on Calotermes and Termes. It is concluded that all the species of Termitidæ belong to one of two main types of colonies, which are:

(1) A colony over which a king and queen preside. The king and queen once possessed two fully developed wings. When a colony is orphaned a pair of royal substitutes or neotinic forms are chosen.

(2) A colony with numerous neotinic queens and with neotinic kings, which are present for only short periods. This type of colony is not founded by the royal forms that govern it, but by detached portions of a preexisting colony.

Many fully winged insects leave the nests of these termites every year. Some of those of *Calotermes flavicolus* found new colonies, but under ordinary conditions those of *Termes lucifugus* are not able to do so, at least in Sicily. The males and females swarm separately, and consequently consanguinous mating is scarcely possible. After settling on decayed trees, the winged Calotermes get rid of their wings and begin to burrow; the sexes pair and each pair founds a fresh colony. Communication between the insects in both genera is by jerking convulsions of the whole body which produce sounds which seem to be heard by the insects, and members of the same nest recognize each other.

The Termitidæ live on triturated, dead, or decayed wood particles mixed with saliva disgorged by their fellows, and their excrement. A colony of soldiers which can not gnaw wood soon dies of starvation, but a single large larva which is constantly burrowing can keep 8 or 10 soldiers alive on its excrement. Dead, diseased, or even healthy but superfluous individuals of the sames species and the salivary secretions are also eaten. Water is sometimes imbibed, but not habitually.

By varying the quantity and proportion of nutriment the insects vary the forms in the colony, obtaining workers, soldiers, and neotinic forms. The neotinic forms are produced by the administration of large quantities of saliva, which gets rid of parasitic protozoa found within the alimentary canal. Newly hatched larvæ receive nothing but saliva, while those destined to become workers or soldiers receive little or none.

Termes lucifugus often migrate from one tree to another, carrying eggs and young. Thus it sometimes happens that communication with the male colony is lost and they are compelled to form new colonies. In Calotermes strangers of the same species are received into the nest. If the colony is orphaned, even a royal pair may be so received. Jealousy among royal forms is less noticeable than in the case of bees.

Some notes on the parasites of Orgyia leucostigma, L. O. Howard (*Proc. Ent. Soc. Washington, 4, No. 2, pp. 60–63*).—In the discussion that followed the reading of this paper, an abstract only of which is given, B. E. Fernow mentioned that twenty years ago on the island of Ruegen in the Baltic Sea an outbreak of *Orgyia pudibunda* occurred, during which the Government expended large sums in an endeavor to destroy the pest. During the progress of this work it was noticed that large numbers of parasites were issuing from the cocoons. Thereupon the work of destruction was stopped and the parasites given an opportunity to finish their work. The result was that next year they had practically exterminated the moth. Thus a large amount of money was saved.

W. T. Swingle referred to a case that came to his notice in Florida in which spraying with Bordeaux mixture resulted in killing a fungus parasite of the orange scale, in consequence of which the scale increased enormously.

W. B. Alwood noted that at Richmond, Virginia, an outbreak of *Goes pulverulenta* on the elm caused losses amounting to from $15,000 to $20,000.

Reports on the results and the cost of liming against the nonne in the Olbersdorf portion of the State Forest Reserve of Augustusburg, Thielemann (*Tharand. Forst. Jahrb., 47 (1897), No. 2, pp. 247–253*).—The cost of labor is placed at 2 marks (57.6 cts.) for men, 1.08 marks (35.7 cts.) for women, and 60 pfennigs (14.3 cts.) for children. The entire cost of liming 9.32 hectares amounted to 325.01

marks ($77.32), or 34.87 marks ($8.30) per hectare. The cost for the collection of nun moths for three years is given as follows: 1894, 794 moths, 110.49 marks; cost per moth, 14 pfennigs; 1895, 701 moths, 137.12 marks; cost per moth, 20 pfennigs; 1896, 398 moths, 63.11 marks; cost per moth, 16 pfennigs. The average number of moths captured per hectare in the three years was 26, 33, and 19, respectively.

FOODS—ANIMAL PRODUCTION.

Comparison of the thermogenetic or dynamogenetic power of simple food stuffs with their nutritive value, A. CHAUVEAU (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 25, pp. 1070–1078, dgms. 2*).—Three experiments with a dog made by the author's usual methods[1] are reported with but few details. In the first experiment the dog was fed a basal ration of meat to which isodynamic quantities of lard and sugar (1:2.373) were added in different periods. The quantities fed were—meat 400 gm., lard 51 gm., and sugar 121 gm.

In the second experiment to a basal ration of meat, fat (lard) and sugar were added in different periods in quantities intermediate between their isodynamic and isoglycogenetic values; that is, in the ratio of 1:1.83. The amounts fed were—meat 500 gm., lard 110 gm., and sugar 200 gm.

In the third experiment to a basal ration of 500 gm. meat was added 110 gm. fat or 168 gm. sugar; that is, the amounts of sugar and fat were proportional to their isoglycogenetic values (the amount of glycogen which could be formed from each). In all the experiments some muscular work was performed.

Among the conclusions reached were the following: The heat of combustion (often assumed to represent the real nutritive value) of sugar and fat is not the measure of the energy which the two substances furnish for the production of force in the animal body. There is a considerable discrepancy between the two values. If the heat of combustion of cane sugar is 1, that of fat is 1.52, and not 2.373, the isodynamic value ordinarily assumed. On the other hand, sugars and fat possess the same nutritive value when consumed in quantities proportional to the amount of glycogen which they can form. Thus, 1.52 gm. of cane sugar or 1 gm. of fat yields 1.61 gm. of glycogen, in the one case by hydration and in the other by oxidation. The different nutrients are not directly sources of potential energy, i. e., of energy in the working muscle. Glycogen alone (which permeates the muscles) can be regarded as the source of muscular work. It is continually used up and renewed and equilibrium maintained.

It is needless to remark on the importance of the bearing of these deductions on the value of sugar as a nutrient.

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[1] The author has devised a respiration apparatus which permits the measurement of the inspired and respired air and a determination of the respiratory quotient. The respiratory movements are also recorded graphically. The amount of muscular work performed may be measured.—Arch. Physiol. Norm. et Path., 5. ser., 8 (1896), pp. 563–571.

The importance of asparagin for animal nutrition, M. CHOMSKY (*Ber. Physiol. Lab. Landw. Inst. Halle, 13, pp. 1-42*).—To study the nutritive value of asparagin an experiment divided into five periods was made with a Southdown sheep. The periods were all of eight days' duration, except the fourth, which was seven days. In the first period the animal was fed a normal ration, which contained as little nonalbuminoid nitrogen as possible. For this purpose oat straw and sesame cake were selected. In the second period the ration contained the same amount of nitrogen-free material, but the amount of protein was diminished. In the third period the ration was the same as in the second period, except that asparagin was substituted for the protein omitted. In the fourth period, the ration was made up of the same ingredients as in the first period but contained a larger quantity of protein. In the fifth period the ration was the same as in the fourth, except that part of the protein was omitted and an equivalent amount of asparagin substituted for it. The food, urine, and feces were analyzed. The results of the experiment are reported in full and are summarized in the following table:

Results of sheep feeding experiment.

Period.	Ration: 600 gm. oat straw, 240 gm. potato starch, and —	Coefficients of digestibility. Dry matter	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Nitrogen in— Food.	Urine.	Feces.	Gain (+) or loss (—) of nitrogen.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*
1	150 gm. sesame cake, 102 gm. cane sugar	59.62	57.62	57.69	44.25	72.15	12.01	4.61	5.09	2.31
2	75 gm. sesame cake, 111.6 gm. cane sugar, 7 cc. sesame oil	51.94	26.57	58.68	35.04	65.40	6.95	1.96	5.10	—0.11
3	75 gm. sesame cake, 111.6 gm. cane sugar, 24.45 gm. asparagin, 7 cc. sesame oil	57.17	51.27	62.27	40.12	70.57	11.51	4.26	5.61	+1.64
4	150 gm. sesame cake, 75 gm. fat-free sesame cake, 102 gm. cane sugar	59.85	62.15	62.89	45.40	71.80	17.08	7.97	6.46	+2.65
5	150 gm. sesame cake, 102 gm. cane sugar, 24.45 gm. asparagin	61.00	66.25	61.39	48.49	71.39	16.58	9.46	5.59	+1.53

At the beginning of the test the sheep weighed 42.4 kg. During the first period he gained 1.7 kg., during the second period his weight remained unchanged, during the third period the gain was 1 kg., and during the fourth and fifth periods 0.9 kg.

In the author's opinion the experiment shows that asparagin can take the place of protein only when combined with carbohydrates; that is, when it forms part of a normal ration or one containing an amount of carbohydrates greater than necessary. Asparagin does not simply improve the digestibility of carbohydrates, but exercises a definite function which is different from that of carbohydrates.

The author also reports an experiment with the same sheep in which amid nitrogen was substituted for protein. The amid nitrogen was supplied in the form of beets. The ration consisted of 600 gm. of oat

straw, 3,500 gm. of beets, and 11 cc. of sesame oil. According to the author's analysis, this furnished 27.43 gm. of true protein, 13.72 gm. of amids, and 9.10 gm. of nitrates. The test lasted 8 days. The daily nitrogen balance was as follows: In food 7.72 gm., in urine 2.77 gm., in feces 4.02 gm.; gain, 0.93 gm. The coefficients of digestibility were: Dry matter 55 per cent, protein 47.9 per cent, fat 53.1 per cent, crude fiber 34.9 per cent, and nitrogen-free extract 66.3 per cent. The sheep gained 0.5 kg. in weight during the eight days. In the author's opinion this test does not warrant general deductions.

The work of other investigators with asparagin is reviewed at length and many experiments quoted in detail.

Examination of Swedish fodder plants, IV, A. G. KELLGREN and L. F. NILSON (*K. Landt. Akad. Handl. Tidskr., 36 (1897), No. 5, pp. 299–370*).—In continuation of work previously reported (E. S. R., 4, pp. 768, 971; 7, p. 497) the authors give the results of a study of the economic flora of Sweden, especially of the northern regions. Analyses are reported of 6 samples of grasses, 16 of Cyperaceæ, 25 of Leguminosæ, and 6 of miscellaneous plants. The investigation includes a comparison of *Trifolium pratense* grown from native seed and seed from a number of countries. In the following table is given the composition of a number of the feeding stuffs. The greater number of them were grown at the experiment station at Albano (near Stockholm).

Composition of Swedish fodder plants.

Name of variety.	Water.	Protein.	Ether extract.	Crude fiber.	Nitrogen free extract.	Mineral matter.	Total nitrogen.	Digestible nitrogen in total.	Amid nitrogen in total.
GRASSES.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Bromus inermis	7.10	7.60	1.84	31.19	45.40	7.47	1.120	75.3	13.9
Dactylis glomerata	6.27	12.69	2.68	31.23	38.46	8.67	2.030	85.2	19.5
Festuca elatior	6.79	6.78	1.48	33.99	44.22	6.74	1.085	75.8	24.9
LEGUMES.									
Anthyllis vulneraria	7.72	13.91	1.94	28.86	37.13	10.44	2.225	84.7	30.8
Astragalus cicer	6.59	11 67	1.64	28.37	41.18	10.55	1.867	88.1	25.7
Astragalus falcatus	6.14	15.17	1.87	26.38	41.07	9.37	2.426	89.7	27.4
Astragalus glyciphyllus	7.11	10.62	1.91	25.37	45.52	9.47	1.699	88.1	16.2
Astragalus glyciphyllus	7.46	19.00	1.99	22.86	41.04	7.65	3.040	89.3	28.6
Lathyrus heterophyllus	6.65	22.73	3.06	28.20	30.64	8.72	3.637	91.2	35.3
Lathyrus latifolius	6.65	18.99	1.87	33.53	31.69	7.27	3.038	90.9	39.4
Lathyrus maritimus	6.76	15.45	3.47	28.41	37.52	8.39	2.473	85.8	34.3
Lathyrus maritimus	5.75	13.37	2.48	29.52	41.96	6.92	2.140	78.6	19.5
Lathyrus platyphyllus	7.05	27.71	2.34	23.14	33.45	6.31	4.442	92.9	42.9
Melilotus alba	6.79	17.61	1.55	32.60	32.36	9.09	2.818	92.0	38.9
Melilotus macrorhiza	6.86	8.41	1.16	39.16	36.90	7.51	1.345	82.4	24.0
Onobrychis sativa	6.32	9.91	1.67	28.79	47.15	6.16	1.586	60.3	12.6
Orobus tuberosus	6.19	20.84	2.91	20.27	43.88	5.91	3.336	89.2	16.9
Orobus vernus	6.92	22.80	1.35	23.66	38.56	6.71	3.648	92.7	31.7
Trifolium pannonicum	6.07	13.47	1.25	28.87	39.83	10.51	2.155	80.5	17.2
Trifolium pratense (Swedish seed)	7.12	13.08	1.93	25.98	43.89	8.00	2.094	83.1	21.4
Trifolium pratense (Norwegian seed)	7.21	13.17	1.87	26.37	43.07	8.31	2.108	85.6	23.3
Trifolium pratense (Schlesian seed)	6.72	13.82	1.92	24 96	44.65	7.90	2.211	83.0	20.2
Trifolium pratense (English seed)	6.54	12.82	1.72	26.13	44.40	8.39	2.051	83.7	22.5
Trifolium repens	6.81	16.06	1.78	15.98	50.42	8.95	2.570	90.3	30.6
Vicia altissima	6.52	14.95	1.58	33.02	36.77	7.16	2.391	87.9	29.7

—F. W. WOLL.

The cooking of meat (*Rev. Gén. Sci. Pures et Appl., 8 (1897), No. 19, p. 766*).—A brief summary is given of experiments by G. Fiore[1] and E. Vallin[2] on the temperature of the interior of meat cooked in different ways. Fiore measured the temperature by inserting bits of metal, whose temperature of fusing was known, into the interior of pieces of meat. Pieces of meat were also inoculated on the surface and interior with a solution rich in the spores and bacilli of charbon. After cooking the meat in various ways guinea pigs were inoculated with the meat juice. It was found that prolonged broiling was the most satisfactory method for destroying the bacilli and the spores. The broiling, roasting, and brazing practiced were not entirely satisfactory.

Vallin tested the temperature of different parts of the meat by the introduction of capillary tubes containing chemical substances whose melting point was known. In general his conclusions were the same as those cited above. He calls attention to the fallacy of the popular opinion that rare meat is more nutritious and digestible than well-cooked meat.

Pig-feeding experiments, J. KLEIN (*Milch Ztg., 26 (1897), Nos. 8, pp. 114–116; 9, pp. 130–133*).—The author reports experiments made at the Dairy Institute at Proskau in 1896 to study the nutritive value of skim milk, beans, peas, whey, and potatoes. The eight pigs used were divided into four lots, each lot including a boar and a sow. The test, which began July 15 and continued twenty-four weeks, was divided into four periods of 35, 42, 42, and 49 days, respectively. Lot 1 was fed skim milk, whey *ad libitum*, potatoes, and beans; lot 2 received the same ration as lot 1 except that peas were substituted for beans; lot 3 had the same ration as lot 1 except that the quantity of beans was decreased one-half and the quantity of skim milk proportionately increased; lot 4 received the same ration as lot 1 except that half as much whey was fed and a proportionately larger amount of potatoes.

It was assumed that 1 kg. of skim milk was equivalent to 120 gm. of beans and that 3.2 kg. of whey was equivalent to 1 kg. of potatoes. A slop was made of the different feeding stuffs, the beans or peas being first soaked and the potatoes cooked and mashed. In the early part of the test the milk and whey were fed warm.

For four weeks before the beginning of the test proper the pigs ate 628.25 kg. of skim milk, 157 kg. of whey, and 47.5 kg. of potatoes and gained 37.5 kg. in weight.

One of the pigs in lot 2 was sick and was dropped at the end of the second period.

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[1] Ann. Ig. Sper., 1897, No. 1, p. 21.
[2] Rev. Hyg. et Police Sanitaire, 1897, No. 9.

A detailed statement is given of the gains made during the test proper. The average results were as follows:

Results of pig feeding.

	Length of test.	Food consumed.					Gain in weight.
		Skim milk.	Whey.	Potatoes.	Beans.	Peas.	
	Days.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
Lot 1	168	427	1,897	896	126.0	....	148.5
Lot 2	77	343	483	196	....	37.8	48.5
Lot 3	168	931	1,897	896	65.3	....	151.5
Lot 4	168	427	987	1,176	126.0	....	144.0

The rations fed to lots 1, 3, and 4 were regarded as of practically the same value. In the author's opinion the assumption was warranted that skim milk could be substituted for beans and whey for potatoes in the proportions mentioned above.

The pigs were slaughtered after the conclusion of the test, and the live weight and dressed weight were recorded as well as the thickness of the bacon and the amount of belly fat.

Pig-feeding experiments, J. KLEIN (*Milch Ztg.*, *26* (*1897*), *Nos. 51, pp. 807, 808; 52, pp. 824–827*).—In continuation of the work reported above the author made experiments with pigs in 1897. Eight Meisen-Yorkshire boars were divided into four lots of two each. Lot 1 was fed skim milk, barley, and potatoes; lot 2 the same ration as lot 1, except that whey was substituted for skim milk; lot 3 the same ration as lot 1, with soaked peas substituted for part of the skim milk; and lot 4 the same ration as lot 3, except that the peas were cooked.

The test proper began May 17 and continued twenty-two weeks. It was divided into three periods of 42, 42, and 70 days. During the four weeks before the beginning of the test proper the pigs consumed 840 kg. of skim milk, 56 kg. of barley, and 140 kg. of potatoes, and made a total gain of 73.25 kg. The food consumed and the gains made during the test proper are recorded in full.

The third period with lot 3 covered only forty two days. In order that a comparison may be made between lots 3 and 4 the food consumed and gains made by lot 4 during the same length of time are included in the following table, which shows the average results for the 4 lots:

Results of feeding pigs.

	Length of experiment.	Food consumed.					Gain in weight.
		Skim milk.	Barley.	Potatoes.	Whey.	Peas.	
	Days.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
Lot 1	154	1,309	480.9	472.5	....	....	166.50
Lot 2	154	574	480.9	472.5	980	....	172.50
Lot 3	126	504	372.4	364	....	73.5	145.00
Lot 4	154	574	480.9	472.5	....	94.5	173.75
Do	126	504	372.4	364	....	73.5	147.90

In the first period the nutritive ratio of the rations fed to the four lots and the corresponding gains made were—Lot 1, 1:5.3, 21.38 kg.; lot 2, 1:6.2, 22.63 kg.; lot 3, 1:5.3, 23 kg.; lot 4, 1:5.3, 24.13 kg. In the second period the corresponding figures were—Lot 1, 1:5.56, 26 kg.; lot 2, 1:6.6, 26.75 kg.; lot 3, 1:5.8, 26.38 kg.; lot 4, 1:5.8, 26.13 kg.; and in the third period, lot 1, 1:6.1, 35.88 kg.; lot 2, 1:1.73, 36.88 kg.; lot 4, 1:6.6, 36.13 kg.

In every case the greatest gains were made on the ration with the widest nutritive ratio. One kilogram of skim milk was found to be equivalent to 125 gm. of peas. In the author's opinion the cooked peas were to be preferred to the soaked peas.

At the conclusion of the test the pigs were slaughtered. Data are given concerning the live weight, dressed weight, thickness of belly fat, and bacon. The percentage of water, iodin value, melting point, and viscosity of the fat were determined. The test is discussed at some length from a financial standpoint. Substituting whey for part of the skim milk in lot 2 effected a saving of $2.40, estimating skim milk at 0.6 ct. and whey at 0.15 ct. per kilogram. It was calculated that 1 kg. of skim milk gave a return of 1.152 cts.

Horse feeding: Tests of the digestibility of oats, hay, and the "new corn product," H. J. PATTERSON (*Maryland Sta. Bul. 51, pp. 46*).—Tests were made with two horses weighing about 850 and 950 lbs., respectively, to determine the digestibility of timothy hay, oats (whole and ground), shelled corn, corn meal, and the "new corn product." The new corn product is prepared by grinding cornstalks, from which the blades, husks, and pith have been removed, into meal which in general appearance resembles coarse bran, dried malt sprouts, or brewers' grain.

The digestion experiments were usually of fourteen days' duration, nine days being regarded as a preliminary period. Analyses were made of the food and feces, and the nitrogen in the urine was determined (except in the test with ground oats), thus giving data for the study of the metabolism of nitrogen. The digestibility of timothy hay was first determined. In the rations in which hay was fed with other materials the amount of hay digested was deducted from the total amount digested in determining the coefficient of digestibility of the other materials.

In one instance the horses were fed a mixed ration containing no coarse fodder except the new corn product. It was made up as follows: New corn product 50 per cent; hominy chop, ground oats, ground rye, and linseed meal each 10 per cent; and gluten meal and wheat bran each 5 per cent. In the author's opinion such a ration possesses an advantage over ordinary rations, as all the ingredients, including the coarse fodder, can be mixed together.

The coefficients of digestibility in the different experiments are shown in the following table:

Coefficients of digestibility of rations fed to horses.

	Dry substance.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Timothy hay:						
Horse 1	47.77	23.97	50.78	50.51	48.34	39.03
Horse 2	39.30	18.35	43.79	44.05	36.90	28.96
Average	43.54	21.16	47.28	47.27	42.62	33.99
Whole oats:						
Horse 1	77.24	87.98	80.00	83.52	49.01	30.61
Horse 2	67.51	84.22	84.83	75.23	13.26	35.60
Average	72.38	86.10	82.42	79.38	31.14	33.10
Ground oats:						
Horse 1	72.91	81.44	78.77	85.23	.61	9.55
Horse 2	78.55	83.44	81.04	87.00	28.11	48.85
Average	75.73	82.41	79.90	86.12	14.36	29.20
Shelled corn:						
Horse 1	78.08	75.84	52.54	91.57	....	32.00
Horse 2	70.81	39.80	42.88	84.82	....	20.50
Average	74.44	57.82	47.71	88.19	....	26.25
Corn meal:						
Horse 1	83.96	77.18	70.21	92.74	....	....
Horse 2	92.82	73.95	75.99	98.70	....	62.66
Average	88.39	75.57	73.10	95.72	....	....
New corn product:						
Horse 1	59.32	70.04	47.56	54.37	70.75	37.47
Horse 2	40.40	65.05	72.00	39.53	38.39	5.96
Average	49.86	67.54	59.78	46.95	54.57	21.72
Mixed ration, with new corn product base:						
Horse 1	63.82	79.96	73.60	71.28	38.66	15.35
Horse 2	61.34	79.26	75.80	67.70	33.65	24.45
Average	62.58	79.61	74.70	69.49	36.16	19.90

The following table shows the food consumed per day and the average income and outgo of nitrogen:

Income and outgo of nitrogen in experiments with horses.

	Food consumed per day.	Duration of experiment.	Nitrogen in food.	Nitrogen in urine.	Nitrogen in feces.	Gain (+) or loss (—).
		Days.	*Gm.*	*Gm.*	*Gm.*	*Gm.*
Horse 1	5,143 gm. timothy hay	7	36.6	36.7	27.8	—27.9
Horse 2	6,000 gm. timothy hay	5	42.7	33.1	34.9	—25.3
Horse 1	2,186 gm. timothy hay, 6,000 gm. whole oats.	5	134.8	67.9	26.2	+40.7
Horse 2	3,278 gm timothy hay, 6,000 gm. whole oats.	5	142.6	74.9	37.9	+29.8
Horse 1	3,000 gm. timothy hay, 3,000 gm. shelled corn.	5	62.3	26.5	26.1	+ 9.7
Horse 2	do	5	62.3	22.7	42.1	— 2.5
Horse 1	3,000 gm. timothy hay, 2,870 gm. corn meal.	5	64.0	16.5	26.0	+21.5
Horse 2	3,000 gm. timothy hay, 3,500 gm. corn meal.	5	73.3	38.7	31.9	+ 3.7
Horse 1	2,950 gm. new corn product, 2,950 gm. ground oats.	5	93.3	31.4	20.9	+41.0
Horse 2	3,350 gm. new corn product, 3,350 gm. ground oats.	5	105.9	54.2	24.0	+27.7
Horse 1	6,000 gm. mixed ration, including new corn product.	5	103.9	47.2	24.8	+51.9
Horse 2	7,500 gm. mixed ration, including new corn product.	5	154.9	74.8	32.1	+48.0

In every case the total amount of food consumed, the water drunk, and the weight of the horses at the beginning and end of the experiment are recorded.

An attempt was also made to feed the horses on oats alone. At the beginning of the trial one horse consumed 6,000 gm. and the other 6,750 gm. of oats per day, but after a few days refused to eat. The experiment could not be continued long enough to permit the determination of the coefficients of digestibility.

The author's conclusions are summarized as follows:

"(1) Timothy hay proved to be less digestible by horses than by ruminants.

"(2) Grinding oats increased their digestibility.

"(3) Corn meal was considerably more digestible than shelled corn.

"(4) Feeding concentrated foods or grain with hay decreased the digestibility of the hay.

"(5) It is impossible to maintain horses on a grain ration alone; they must have a long forage.

"(6) Making a 'mixed feed,' of the grain and long forage is the best manner of feeding horses.

"(7) The new corn product was better digested by horses than timothy hay.

"(8) Grinding fodder to the condition of the new corn product or of coarse bran does not destroy its value as long forage."

Several tests were made of the value of the new corn product as a substitute for hay under various conditions of work. In the author's opinion, those who attempt to feed this material for the first time should gradually accustom the horses to it before substituting it entirely for hay. He believes it may be successfully used as a hay substitute.

Poultry experiments, J. DRYDEN (*Utah Sta. Bul. 51, pp. 33, pls. 4*).—In the winter of 1896–97 feeding tests were made with nine lots of chickens to test the influence of age, breed, and exercise on the amount and cost of egg production. In addition, the relative fertility of eggs under different treatments and the relative value of two incubators was also tested.

Lots 1 to 8, inclusive, were made up of 4 chickens each, and lot 9 of 5 chickens. Lots 1 to 6 were Rose-Comb Leghorns, lot 7 Brahma-Leghorn pullets, lot 8 Light Brahma pullets, and lot 9 Barred Plymouth Rock pullets. Lots 1 and 5 were old hens, lots 2 and 6 late hatched pullets, and lots 3 and 4 early hatched pullets. Lots 1 to 3 had no exercise; they were fed grain from boxes. Lots 4 to 9 had exercise, the grain fed being scattered in straw litter. In other respects all the lots were treated alike. The food consisted of a mash of bran and shorts, chopped corn, and oats, 2 : 1 : 1, fed in the morning with a little whole grain (a mixture of wheat, corn, oats, and barley). The corn was fed sparingly and the barley was discontinued after a short time, since it was not relished by the chickens. In the evening whole grain only was fed. The chickens were usually given cut meat and bones three times a week, and were supplied with cabbage or other green food. Occasionally they were given a little cayenne pepper during the winter, and they had access to coal ashes and gravel.

The results of the feeding tests are summarized in the following table:

Results of feeding tests with chickens.

Lot.		Cost of food.	Number of eggs laid.	Value of eggs.	Cost of food per dozen eggs.	Average weight of eggs per dozen.	Average weight of eggs per year per fowl.
	WITHOUT EXERCISE.	*Cents.*			*Cents.*	*Pounds.*	*Pounds.*
1	Old hens	53¼	64	$0.56	9.9	1.57	8.4
2	Late hatched pullets	56¼	137½	1.32	4.9	1.40	15.98
3	Early hatched pullets	61¼	157¼	1.68	4.6	1.49	19.51
	WITH EXERCISE.						
4	Early hatched pullets	62	181¾	1.88	4.1	1.42	21.46
5	Old hens	62	106¼	1.00	6.9	1.52	13.54
6	Late hatched pullets	63	150¾	1.51	5.0	1.39	17.42
7	Brahma-Leghorn pullets	73¼	145	1.47	6.1	1.52	18.39
8	Light Brahma pullets	81¼	147¼	1.40	6.6	1.63	20.03
9	Barred Plymouth Rock pullets	63	79¼	.79	9.4	1.48	9.8

The principal conclusions reached were the following: The profit in feeding young hens or pullets was six times as great as in the case of hens three or four years old. Early hatched Leghorn pullets gave better results than those hatched later. The chickens which had exercise consumed more food and produced more eggs at less cost than those which had no exercise. Exercise had no apparent effect on the weight of the chickens. However, the eggs produced by the chickens having no exercise weighed 3 per cent more than those produced by the chickens having exercise. The eggs of the Leghorn hens weighed more than those of the Leghorn pullets, and those of the Light Brahma pullets more than those of the Leghorn pullets. The eggs of the Barred Plymouth Rock pullets averaged about the same as those of the Leghorn pullets. In the author's opinion, with intelligent care and feeding the average capacity of a Leghorn pullet is 200 eggs per year. No advantage was observed in crossing Brahmas and Leghorns.

A trial of two different incubators was made. This included a comparison of the relative fertility of old, medium, and fresh eggs of the different lots of chickens mentioned above. The data were not regarded as sufficient for drawing definite deductions concerning the incubators. Exercise apparently reduced the percentage of fertility of the eggs. The percentage of fertility was highest with eggs from early hatched pullets and lowest with eggs from old hens, though the results are not regarded as conclusive. The fertility of eggs averaging five days' old was 300 per cent greater than eggs averaging twenty-two days' old.

The bread of Italian peasants, R. CASTELANI (*Ann. Ig. Sper., n. ser., 6 (1896), No. 1, pp. 89–110*).—The composition is reported of bread made from wheat, corn, rye, barley, oats, millet, rice, legumes, potatoes, acorns, and chestnuts. These materials were used alone or in different combinations. The samples of bread were gathered from different provinces.

Chemical composition of several sorts of flour used in Belgium, LECOCQ (*Bul. Assoc. Belge Chim., 10 (1896), p. 316; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. 326*).—The maximum, minimum, and average protein, fat, ash, and water in several sorts of fine wheat flour are recorded. When the figures for ash and protein were unusual, the starch and cellulose were also determined.

A Soudanese cereal (*Gard. Chron., 3. ser., 23 (1898), No. 590, p. 232*).—An editorial note on the use of *Paspalum longiflorum* in Soudan. This grain has the following percentage composition: Water 9.20, protein 7.67, fat 5.34, starch and dextrin 77.33, crude fiber 2.56, undetermined 3.90. For purposes of comparison the analyses of other cereals are given.

A study of the constitution of the gluten of different cereals; the influence of this factor on the value of flour for bread making, E. FLEURENT (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 64–70*).

Average analyses of Danish concentrated cattle foods, V. STEIN (*Holt's Lommebog Landm., 1898, p. 67*).

The carbohydrates of barley and malt, A. R. LING (*Gaz. Brasseur., 1898, Nos. 537 and 538*).

Contribution to the study of maize diet, G. PANEGROSSI (*Ann. Ig. Sper., n. ser., 6 (1896), No. 3 pp. 293–350*).—A number of experiments with a man are reported on the digestibility of Italian flour of different grades as compared with flour ground by Sheppard's process and with maize ground by Sheppard's process and by the ordinary method. In every case the food consisted entirely of the material tested prepared in the form of cake and porridge or mush. The food and feces were analyzed and the nitrogen in the urine was determined.

Experiments on the nutritive value of bread made from old-process and roller-process flour, L. BOUTROUX and A. BOUTROUX (*Ann. Hyg. Pub et Méd. Légale, 3. ser., 35 (1896), pp. 336–345*).—Experiments are reported in which white mice were fed bread made from old-process and roller-process flour. The amounts consumed and the gains and losses in weight are recorded. The mice consumed larger quantities of the bread made from old-process flour and utilized it more completely as shown by the gains in weight. The flours were of about equal fineness and had the same gluten content.

The value of the two flours for man is discussed at some length and experiments of other investigators cited.

Hygienic measures in the expedition to Madagascar, J. LÉMURE (*Ann. Hyg. Pub. et Méd. Légale, 3. ser., 35 (1896), pp. 223–242*).—In addition to other matter the author discusses the food and water supply of the French troops in Madagascar. The rations prescribed by the Minister of War are quoted in some detail.

A new investigation on the digestibility of eggs, especially of egg albumin, JORISSENNE (*Jour. Hyg., 23 (1898), Nos. 1121, pp. 131, 132; 1122, pp. 143, 144*).—The author has condensed the conclusions drawn from an extended investigation, the details of which are not quoted. The subject is treated chiefly from a medical standpoint.

Composition of meat peptones, PY (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 5–8*).

The pentosans in different feeding stuffs with some considerations on vegetable chemistry and the analysis of fodders, MENOZZI (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 251–255*).—The pentosan content of *Boletus edulis*, mulberry leaves, silkworm excrement, and a number of feeding stuffs used in Lombardy is reported. No pentosans were found in *Penicillium glaucum* grown on gelatin.

Can vinegar from alcohol be legally sold under the name of vinegar? Investigation of artificial vinegars. Percentage of reducing substances, S. DE RACZKOWSKI (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 250–260*).

Coffee, PY (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 320–336, pls. 7*).—Coffee

and coffee adulterants are described, especial attention being given to microscopical characteristics and chemical composition.

The detection of artificially colored coffee, G. MORPURGO (*Rev. Internat. Falsif., 11 (1898), No. 1, p. 27; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. 325*).

Determination of tannic acid in coffee, TRILLICH and GÖCKEL (*Ztschr. Nahr. Untersuch. u. Hyg., 12 (1898), p. 101; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. 326*).

Relation between the properties of different kinds of tea and the caffein content of tea, L. GRAF (*Rev. Internat. Falsif., 11 (1898), No. 1, p. 20; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. 326*).

The detection of corn flour and the adulteration of wheat flour, C. U. SMITH (*Health Mag., 5, No. 10, pp. 285, 286*).—The author recommends the following as a simple test for the adulteration of flour with corn flour: Treat a small sample with a 50 per cent solution of acetic acid, making a very thin smooth paste; allow it to stand fifteen minutes; spread on a microscope slide on a thin film and examine with a two-thirds or three-fourths objective while moist. Wheat starch grains are unchanged. Corn starch grains take on a characteristic color.

Sophistication and adulteration of preserved food, DURAND and X. ROCQUES (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 190–199*).

Investigation by the Société Française d'Hygiene of the sanitary condition of the food supply of Paris (*Jour. Hyg., 23 (1898), Nos. 1122, pp. 139–143; 1123, pp. 151–155*).—As a result of investigation the society recommends the proper inspection of bakeries, kitchens, restaurants, and other places where food is prepared, both for the benefit of the public and of the employees.

The formation of fat in the body in phosphorus poisoning, O. POLIMANTI (*Arch. Physiol. [Pflüger], 70, No. 7–8, pp. 349–365*).—A number of experiments (with suitable control tests) were made with frogs poisoned with phosphorus. In some cases the frogs were killed, in others the experiments continued until the frogs given phosphorus died. The livers were especially examined. Their fat content was determined by the Dormeyer method (digesting with pepsin and hydrochloric acid and extracting with ether). Those of the frogs given phosphorus had the appearance of bacon.

The author concludes that his experiments show the formation of fat from protein in cases of phosphorous poisoning, and further, that the central nervous system is not concerned in the changes brought about by the phosphorus. In addition to the increase in fat there is also an increase in the water content of the body.

Contribution to the physiology of the formation of fat and glycogen and phosphorus poisoning, E. PFLÜGER and J. ATHANASIU (*Arch. Physiol. [Pflüger], 71, No. 5–6, pp. 318, 322*).—This is a controversial article. The authors do not agree with the conclusions of O. Colosanti concerning the formation of fat from protein in phosphorus poisoning.

Formation of fat from protein in cats, M. CRAMER (*München. Med. Wchnschr., 44 (1897), No. 29, p. 411*).—The author reports briefly some of his experiments with cats on the possibility of the formation of fat from protein. The food, urine, feces, and gaseous excretory products were analyzed. A respiration apparatus was employed for the measurement of the respired air. In a test when the subject fasted it was calculated that 7.3 gm. of carbon must have been derived from the cleavage of protein of body tissue. A test in which the subject was fed an abundance of meat is also referred to, though fewer details are given.

The author concludes that his results confirm Voit's theory of the formation of fat from protein.

The influence of antiseptics on the digestion of blood fibrin by pepsin in a hydrochloric acid solution, C. F. MABERY and L. GOLDSMITH (*Jour. Amer. Chem. Soc., 19 (1897), No. 11, pp. 889–894*).—Experiments were made to determine the effect

of alum, salicylic acid, boric acid, and formalin on the digestion of blood fibrin by hydrochloric acid and pepsin. Tests were also made to determine the effect of alum baking powder upon the digestibility of bread. It was found that even small amounts of alum decreased the digestibility and this effect increased markedly when large quantities were used. Boric acid decreased digestibility but the effect did not seem to be regularly dependent upon the quantity of acid used. Formalin diminished digestibility somewhat more than boric acid and the effect increased with increased quantities of the antiseptic. The effect of alum was more marked than that of either of the other substances.

The formation of gas in pancreatic digestion, F. KLUG (*Arch. Physiol.* [*Pflüger*], *70, No. 7–8, pp. 329–345*).—The author reports a number of artificial digestion experiments from which the following conclusions were drawn: It is extremely probable that when fat undergoes digestion there is cleavage not only to fatty acids, glycerin, and soaps, but also a deeper cleavage resulting in carbon dioxid and hydrogen as final products. This suggests the effect of trypsin on albumen. The primary products are albumoses and peptones, but by continued action leucin, tyrosin, and glutaminic acid are formed. As in the case of albumen the cleavage of fat may be more complete than is profitable for the body.

Experimental investigations on the effect of copper on animals and its absorption and excretion, J. BRANDL (*Arb. K. Gesundheitsamte, 13 (1896), No. 1, pp. 104–136*).—Experiments were made with dogs and rabbits in which various copper compounds were injected into the circulatory system or taken into the stomach. Among the conclusions reached were the following: The effect of copper is most marked in the case of salts that are easily absorbed. When copper salts are taken into the stomach the poisonous action is affected by the contents of the stomach and intestines. Compounds of copper albuminates have less effect than salts since only a small portion is absorbed and a still smaller portion is taken up into the general circulation. Only small amounts of copper are excreted by the epithelia cells of the intestines and in the urine. Very little is found in the saliva and milk. On the other hand, copper is excreted slowly but continuously through the gall and is seldom stored up in any perceptible quantity.

Influence of alcohol on muscular work, E. DESTRÉE (*Rev. Sci.* [*Paris*], *4. ser., 9 (1898), No. 17, p. 536*).—A brief note on experiments in which a dynamometer was used. This showed, in the author's opinion, that alcohol first increased muscular work and then diminished it.

Determination of the coefficient of oxidation of nitrogenous material, L. MONFET (*2. Congrès Internat. Chim. Appl., 1896, IV, p. 70*).—By coefficient of oxidation of nitrogenous material is meant the ratio of nitrogen of urea to total nitrogen of urine.

A method of preparing fat-free meat, O. FRANK (*Ztschr. Biol., 35 (1897), No. 4, pp. 549–554*).—The author proposes the following method for removing the fat from meat: Cover the finely chopped meat with 96 per cent alcohol, soak for twenty-four hours, shaking often, and remove the alcohol with a pipette. Repeat the treatment three times with absolute alcohol and then with ether, dry the meat residue, pulverize, and extract twenty-four hours with ether in a Soxhlet apparatus. Unite all the alcohol and ether extracts, evaporate at gentle heat (preferably in a vacuum), and dry in a vacuum at 100°. Take up the residue with chemically pure ether, or better still, with petroleum ether (boiling point 60°), filter, evaporate, and weigh. If a clear solution is not obtained, evaporate and dissolve a second time in petroleum ether. This method of extracting fat gives about 10 per cent more than the ordinary method in terms of the total fat estimated.

The author compares his method with that in ordinary use. When 6.851 gm. of meat powder dried at 70° was extracted by the ordinary method ether extract equal to 2.57 per cent of the total substance was obtained. When 24.12 gm. of fresh meat

was extracted by the alcohol-ether method the quantity of ether extract obtained was equal to 2.89 per cent of the total substance.

In order to show that the residue from extraction with alcohol and ether was free from fat the author dissolved the residue from 20.52 gm. of fresh meat in 50 per cent sulphuric acid, extracted the solution with ether, and obtained only 0.0021 gm. of ether extract.

In the author's opinion, when muscle fat is heated in the presence of moisture at 100° in the ordinary method of drying meat for extraction, cleavage takes place.

In carrying on the investigations, it was observed that the ether extract from muscular tissue contained a high percentage of free acid. Since there is little fat in subcutaneous connective tissue, as also in the insoluble fat of the muscles, it seemed possible that the fatty acid was in some way connected with the muscle protoplasm and was dependent upon muscular exertion. Experiments were therefore made with a dog and the amount of fat in working muscles was compared with that in resting muscles. Contradictory results were obtained.

On account of its interest in connection with a discussion of the formation of fat from protein, the author repeated an experiment made some years ago by F. Hoffmann. Maggots of flies were grown upon meat which had been extracted for fourteen days in a Soxhlet apparatus. After seven days the maggots were analyzed and it was found that they contained more fat than maggots had been shown to contain at the beginning of the test. Since the gain in fat was not large it can not be said with certainty that it was not made at the expense of the small quantity of fat remaining in the meat after the fourteen days' extraction with ether.

Feeds and feeding, W. A. HENRY (*Madison, Wis.: The author, 1898, pp. IV + 657*).—This is a comprehensive manual edited for students and practical feeders. It is divided into three main sections, (1) plant growth and animal nutrition, (2) feeding stuffs, and (3) feeding farm animals. Under the first section the growth of the plant and its suitability for animal food and the digestion and assimilation of food by animals are discussed, as well as the laws of animal nutrition, the source of energy in the animal body, the influence of food on the composition of the body, and similar topics. Directions are given for calculating rations for different animals under different conditions. Under the second main division the different cereals, oil-bearing and leguminous seeds, the by-products made from them, forage plants, roots, and miscellaneous feeding stuffs are described and discussed; the manurial value of the different feeding stuffs is treated of at length, and soiling and ensiling are described. In the third main division feeding the different farm animals for growth or for the production of force is treated in detail as well as the feeding of dairy cows for the production of milk. Special attention is also given to the feeding of sheep for wool.

The author has made an extended study of the experiment station publications on the various subjects treated of, as well as the general foreign and American literature. The work of many investigators and the conclusions drawn are quoted with much detail. In many instances results are discussed in their bearing upon other investigations. In an appendix the average composition of the principal feeding stuffs is given, feeding standards are quoted, and a glossary of the more unusual terms is included. The value of the work is increased by the citation of references and an index.

Hay of Norwegian fodder plants, F. H. WERENSKIOLD (*Tidsskr. Norske Landbr., 4 (1897), No. 10, pp. 436–440*).—A continuation of the study of the composition of Norwegian fodder plants begun by the author in 1894 (E. S. R., 6, p. 568; 9, p. 268). The present report includes analyses of samples of hay from legumes (8 samples) and from grasses (15 samples).—F. W. WOLL.

The method to be followed in considering the subject of animal production, MÜLLER (*Jour. Landw., 46 (1898), No. 2, pp. 143–151*).—The author divides the sub-

ject into (1) breeding, (2) feeding and feed stuffs, (3) hygiene, (4) races, breeds, and strains of domestic animals, and (5) societies for the advancement of animal production. These main divisions are further subdivided.

Feeding of new oats (*Tidskr. Landtmän, 18 (1897), No. 37, pp. 665, 666*).—It is stated that from eight to ten weeks should pass after harvesting before oats are fed to horses.

Measurements and weights showing the development of horses and bulls, S. C. A. TUXEN (*Landmansblade, 30 (1897), No. 42, pp. 578–582*).

On the red Danish cattle, (*Landtmannen, 8 (1897), No. 40, pp. 561–564, ill.*).

Potatoes as a food for swine, H. KNUDSEN (*Nord. Mejeri Tidn., 12 (1897), No. 41, pp. 486, 487*).

Horse breeding in Austria-Hungary (*Jour. Bd. Agr. [London], 98, No. 4, pp. 456–460*).—This article, which gives statistics and other information concerning horse breeding in Austria-Hungary, is prepared from a report by M. de C. Findlay in the "Appendix to the Minutes of Evidence taken before the Royal Commission on Horse Breeding in Ireland [C.—8652]."

The hygiene of the horse, H. GOLDSCHMIDT (*Hestens Sundhedspleje. Copenhagen: Det Nord. Forlag., 1897, pp. 104*).

On poultry raising and egg trade in Denmark, A. OEKSNEVALD (*Tidsskr. Norske Landbr., 4 (1897), No. 10, pp. 461–471*).

New treatise on practical aviculture, J. V. LASSERON (*Traité d'aviculture pratique. Paris: Société d'Editions Scientifiques, 1898, pp. 260, ill.*).—This is Volume XI of *Encyclopédie des connaissances pratiques*. It is a popular handbook describing the different breeds of chickens and other poultry. The diseases of poultry are also discussed. There is a chapter on rabbits.

DAIRY FARMING—DAIRYING.

Investigations on the care and keeping of milch cows, BACKHAUS (*Ber. Landw. Inst. Univ. Königsberg, 2 (1897), pp. 34–89*).—These investigations were made upon a part or the whole of the herd at the Agricultural Institute. They include studies of the individual variation in milk yield and the utilization of food by different cows, feeding and milking twice or three times a day, watering, effect of exercise, light in the stable, etc.

The individual variation in milk secretion.—The record is summarized for eight East Prussian Dutch cows, together with the creamability of the milk of each cow, number of fat globules, live weight, etc. The yield of solids-not-fat varied all the way from 2.33 to 3.02 times the total yield of fat with different cows, supporting, the author believes, his theory that some cows are primarily butter cows and others cheese cows. No relation was found between the live weight and the milk production. The milk of different cows varied materially in the size of the fat globules, and this affected the centrifugal creaming of the milk, the effect of the larger globules being noticeable, not especially in the fat content of the skim milk, but in increasing the fat content of the cream.

Utilization of food by milch cows.—From the record of the eight cows the food units consumed are calculated from the digestible food eaten with the use of Kühn's proportion of protein 6, fat 2.5, and nitrogen-free extract 1; and the milk units produced are calculated on the basis of

1 kg. of fat or 5 kg. of solids-not-fat to 1 milk unit. The results of these calculations are given in the following table:

Relation between food consumed and milk produced by different cows.

Cow number.	Total milk units produced.	Total food units consumed.	Food units consumed for production of 1 milk unit.
1	141.80	3,410.70	25.49
2	139.08	3,327.34	23.92
3	113.70	3,270.29	28.76
4	150.48	3,434.69	22.82
5	141.36	3,410.70	24.13
6	120.58	3,095.56	25.67
7	134.18	3,425.24	25.66
8	137.12	3,430.31	25.02
Total	1,078.30	26,804.83	24.86

To the above is added the values of the milk units and food units, and the cows are arranged according to production and profit. The author concludes that the merits of a cow can best be judged of by testing the amounts of food consumed and the production of milk, etc., six months after calving. With a view to finding a practicable means by which the profitable utilization of food by a cow (*futterdankbarkeit*) could be determined, studies were made in which at four different stages of lactation the grain of the eight cows was increased and the effect observed on the production. The periods were each seven days long, the last four days being considered. There was a wide difference among the cows with respect to their response to the increased grain. Some gave no increase, while others in every case gave a noticeable increase in production.[1]

The author considers that the results warrant the making of such tests in practice in studying the value of cows.

Feeding twice and three times a day.—The results are given of three experiments on this subject with different lots of cows. The conclusion is that for milk production alone it is sufficient to feed twice daily, as feeding three times gave no increase in the yield of milk. Physiologically feeding only twice a day is believed to be preferable, as the cows are more quiet under this system. Where the production of beef is considered, feeding three times a day is considered advisable, as there was a greater increase in live weight under that system.

The watering of cows.—The author reports an experiment previously noticed (E. S. R., 4, p. 773). In addition, an experiment is given with eight cows, lasting from September 5 to October 9, 1897. Every other week the cows were supplied with water in the stalls by means of automatic troughs, and on alternate weeks they were watered with pails. The average milk yield was 14.79 kg. when water was supplied automatic-

[1] It would appear that all of the animals were fed the same amount of basal ration and of grain without regard to live weight.

ally, and 14.18 kg. when the cows were watered with a pail. There was practically no difference in the amount of fat and of solids-not-fat produced under the two conditions. The cows drank nearly 2 liters more of water per day when the water was kept before them. Summing up the two experiments, the author believes the results show that automatic troughs materially increase the milk production and are to be recommended.

Effect of exercise on milk secretion.—An experiment on this subject was made with eight cows from October 17 to November 20, the cows being turned out in a yard and allowed to exercise at will for an hour each day on alternate weeks, but during the rest of the time kept in the stable all day. The average yield of milk was 12.31 kg. for the weeks the cows were exercised and 11.88 for the time they were given no exercise. There was practically no difference in the yield of fat and solids-not-fat. An increase in milk yield was shown by all of the cows when they were given exercise.

Milking twice, three times, and four times a day.—An experiment is reported with eight cows in milking twice, three times, and four times daily, the interval between milkings being divided equally. The periods were seven days long and only the last four days of each period were considered. Frequent milking was found to increase the yield of milk, and this was true for fresh cows as well as those well advanced in milking. The author is convinced that under intensive conditions, where milk commands a high price, the increased yield will warrant milking three times a day, dividing the time between milkings as equally as possible. Under other conditions milking twice a day is considered sufficient except in the case of cows giving a large quantity of milk, which should be given two additional milkings. Concerning the composition of the milk at different milkings, on the average of nine weeks of milking twice daily, the morning's milk contained 3.42 per cent of fat and the night's milk 3.47 per cent; the average of three weeks of milking four times a day gave 3.60 per cent of fat for the forenoon's milk and 3.47 for the afternoon's milk. Where the time between milkings was irregular it was found that a milk richer in fat was produced on the shorter interval.

Changes of milk as a result of being in heat.—The results of two series of observations each on five cows are given. The results indicate that the changes in the milk due to the cow being in heat are relatively unimportant and may be entirely avoided when the milk is to be used for ordinary purposes. For special purposes, as the production of milk for infants, it is advisable to reject the milk at this time.

Effect of light.—The results are given of three experiments on the effect of light on cows. In each experiment the windows were darkened during the alternate periods and the stables kept as dark as practicable. In general, the results of all the experiments showed that excluding the light had little effect on the milk production, but the

effect on the live weight appeared to be unfavorable. The advantages of well-lighted stables are considered apparent.

On the influence of the food on the fat content of the milk, F. Friis (*Mälkeritid., 1897, Oct.; Norsk Landmandsblad, 16 (1897), No. 45, pp. 498–501; Biet, 18, (1897), pp. 238–247*).—The author reviews the cooperative cow-feeding experiments conducted at the State experiment station at Copenhagen since 1888, with special reference to the effect of food on the fat content of the milk (E. S. R., 9, p. 490, and previous volumes). The following summary of 76 series of experiments is reproduced from the paper:

Summary of Danish feeding experiments with cows on the effect of food on quality of milk.

Year.	Number of series included.	Lot.	Basal ration.	Additional rations in experimental period.	Fat in milk. Preparatory period.	Fat in milk. Experimental period.	Fat in milk. Post-experimental period.
					Per ct.	*Per ct.*	*Per ct.*
		A	40 lbs.[1] roots, 7 lbs. hay, straw *ad libitum*.	6½ lbs. concentrated feed	3.14	3.13	3.33
1888–89	10	B		Basal ration			
		C		10½ lbs. concentrated feed	3.16	3.19	3.37
		A	3.6 lbs. mixed grain, 2.8 lbs. bran, 3.2 lbs. oil cakes, 5.8 lbs. hay, straw *ad libitum*.	No roots	3.20	3.22	3.23
1888–89	12	B					
		C		36 lbs. roots	3.20	3.22	3.34
		A	7.6 lbs. hay, straw *ad libitum*.	10½ lbs. concentrated feed	3.21	3.22	3.28
1888–90	13	B		8½ lbs. concentrated feed, 20 lbs. roots.	3.16	3.17	3.30
		C		6½ lbs. concentrated feed, 40 lbs. roots.	3.16	3.15	3.33
		A	34 lbs. roots, 7.3 lbs. hay, straw *ad libitum*.	5.4 lbs. mixed grain, 1.8 lbs. oil cakes.	3.22	3.20	3.32
1891–92	16	B		3.6 lbs. mixed grain, 3.6 lbs. oil cakes.	3.20	3.17	3.31
		C		1.8 lbs. mixed grain, 5.4 lbs. oil cakes.	3.23	3.20	3.51
		A	2 lbs. oil cakes, 28.6 lbs. roots, 6.3 lbs. hay, straw *ad libitum*.	6 lbs. mixed grain	3.09	3.04	3.26
1893–94	14	B		3 lbs. mixed grain, 3 lbs. bran.	3.10	3.11	3.29
		C		6 lbs bran	3.10	3.12	3.29
		A	1.7 lbs. oil cakes, 3 lbs. bran, 27 lbs. roots, 9.3 lbs. hay, straw *ad libitum*.	5.2 lbs. mixed grain	3.08	3.09	3.24
1895	6	B		2.6 lbs. mixed grain, 2.6 lbs. wheat.	3.11	3.10	3.25
		C		5.2 lbs. wheat	3.11	3.12	3.29
		A	3 lbs. oil cakes, 30 lbs. roots, 8.4 lbs. hay, straw *ad libitum*.	3½ lbs. mixed grain	3.25	3.16	3.27
1896	5	B		1¾ lbs. mixed grain, 1¾ lbs. molasses feed.	3.23	3.12	3.21
		C		3½ lbs. molasses feed	3.26	3.15	3.27

[1] Amounts are stated in Danish pounds, 1.1 lbs. avoirdupois.

In the opinion of the writer the experiments prove that "the feed under practical conditions, as found in this country, exerts an entirely insignificant (*forsvindende*) influence on the fat content of the milk." It is noted that although the differences in the rations fed to the different lots were considerable the rations may all be regarded as normal for milch cows, such as met with in the feeding practice on Danish dairy farms. The question whether abnormal feed mixtures can appreciably change the fat content of milk was not included in the investigations of the station. Only the effect of the food on the percentage of fat in the milk is considered in this paper. The author notes that the experi-

ments showed that different feeding stuffs and food mixtures in a very large measure influence the quantity of milk yielded, as well as the health and general condition of the cows.—F. W. WOLL.

Obtaining milk under aseptic conditions, BACKHAUS and W. CRONHEIM (*Ber. Landw. Inst. Univ. Königsberg, 2 (1897), pp. 12–32*).—This article treats of the method of obtaining milk as free from germs as possible. The author believes that the more recent investigations show the impossibility of obtaining milk from the udder of the cow, either by milking tubes or by washing the udder, etc., which is entirely free from germs. The results are given of the determination of the germ content of milk from numerous creameries in Göttingen and Königsberg during several months of the year. These showed very wide variations—from about 2,000 to over 20,000,000 germs (per cubic centimeter).

The milk of eight cows of the university herd, which was milked with care into a sterile pail, rejecting the first five spurts of milk, showed a germ content ranging in six trials from 1,800 to 14,750, the average for the whole being 6,660. In many trials using milking tubes or milking into sterile vessels, the lowest germ content found was 1,300. It was frequently found that at a low temperature the germ content of milk changed very little, although in some cases there was a decrease.

The increase which may take place in handling milk by pouring it from one vessel to another and in cooling, is shown by three experiments, summarized as follows:

Germ content of milk before and after handling.

	Experiment of—		
	July 8.	July 14.	November 17.
Directly after milking	14,400	19,600	10,800
After pouring into another vessel	19,400	28,600	6,600
After passing through the milk cooler	21,600	38,000	39,600
After catching in another vessel under the cooler	21,400	78,600	17,600
After filling in bottles and keeping for four or five hours in the cold	35,000	162,000	23,200

Several experiments are given showing the infection from the cow's body, from which it is concluded that the cows should be carded and brushed twice daily and the udder and adjoining parts washed once.

Numerous experiments are also reported on the effect of the surroundings of the cow, bedding, excrement, feed, and manner of milking on the germ content. It is concluded that for obtaining aseptic milk the conditions are best in milking in the open air, although the proper ventilation and general cleanliness of the stall are important matters. Peat is regarded as a very favorable bedding, and if straw is to be used it should be fresh and clean and free from any mold, dampness, etc. The lowest germ content of the milk was observed when peat was used for bedding. Experiments showed that infection with old manure was

especially to be guarded against, as this contains more particularly the peptonizing bacteria. This relates to manure which is allowed to accumulate in the stall or dry upon the cows. Experiments by the author and those cited from other investigators indicate that it is important in obtaining milk with low germ content to avoid all feeding stuffs in a state of fermentation or in a spoiled condition. The germ content may also be reduced by keeping the milk from the first part of the milking—about one fourth—separate from the rest and using it for a different purpose. The use of a milk pail having a cover with only a small hole in the top is recommended instead of an open pail.

The effect of dairy utensils of different kinds—wood, tin, enamel, etc.—is considered, and also the cleaning of dairy utensils. Wooden utensils should be avoided. Sodium hydrate is recommended for cleaning dairy utensils, followed by washing and scalding with water and sterilizing with steam under pressure or in a sterilizing oven.

In conclusion a diagram is given showing the effect of various methods of treatment, as noted above, in reducing the germ content of the milk. It is stated that by avoiding some of the precautions milk may contain 2,000 times as many bacteria as that obtained when all precautions are observed. This shows the importance of employing "aseptic" methods in obtaining and handling milk for domestic purposes.

Some new experiments in churning (*Molk. Ztg., 11 (1897), No. 52, pp. 817, 818*).—A short account is given of some experiments by Fahrenbach at the Agricultural Institute at Leipsic. The effect of the size of the fat globules on the rapidity and the completeness of churning was studied in 8 series of experiments with sweet cream and 6 with ripened cream. The milk of two cows, distinguished by the difference in the size of the fat globules, was mixed, and from the mixture cream with large and with small globules was prepared by a method not noted in the abstract. The two kinds of cream were alike in fat content and in other respects except the size of the globules. The average results with the sweet and ripened cream were as follows:

Churning properties of cream with large and small fat globules.

	Number of globules in 0.000001 cc. of fat.	Time required for churning.	Degree of churnability.
Sweet cream:		*Minutes.*	
Cream with large fat globules	30.04	46	95.12
Cream with small fat globules	104.61	54	91.61
Ripened cream:			
Cream with large fat globules	28.80	42	97.13
Cream with small fat globules	87.30	58	95.00

The cream with large fat globules churned quicker and more completely than that with small globules, and the difference in respect to thoroughness was greater in case of the sweet cream. On an average

the churnability of the ripened cream was nearly 3 per cent greater than that of the sweet cream. Experiments were also made with cream of different fat content and from different kinds of cows. The results of these experiments, which are not detailed in the abstract, showed that under some circumstances the effect of the size of the fat globules on churning may be obliterated by other conditions. A fat content of the cream too high or too low to be advantageous diminishes the churnability in a greater degree than large fat globules increase it. The viscosity of the cream also had a very marked effect on the churning.

An account is also given of von Stockhausen's investigations (E. S. R., 9, p. 1087).

Effect of period of lactation on milk and quality of butter, G. L. McKay and J. W. Wilson (*Iowa Sta. Bul. 36, pp. 865–867*).—In continuation of previous work (E. S. R., 9, p. 91) a test was made with two lots of 4 and 7 cows, respectively, to study the effect of the period of lactation upon milk yield and the quality of butter. The first lot averaged sixty-two days since calving, and the second lot one hundred and ninety-five days. The two lots were fed, under like conditions, the same rations of sheaf oats, clover hay, corn, barley meal, and sugar beets. The total milk yield in fifteen days from lot 1 was 972 pounds, and from lot 2, 886 pounds. The milk from each cow was kept separate, the cream was removed by a separator, and the butter was made and handled by the same methods. The butter was judged by an expert, and no difference was observed as due to a difference in the period of lactation.

The authors believe that the trouble experienced with cream from cows in an advanced stage of lactation is due to the fact that the cows are not fed a sufficiently succulent ration. As the period of lactation advances the fat globules in the milk become smaller and the cream more viscous. Succulent food, it is stated, will cause a more abundant secretion of milk furnishing less viscous cream. The authors also advise the addition of sour milk to start the ripening of the cream. This insures a rapid development of lactic-acid fermentation, and retards the growth of undesirable microorganisms. When the cream is properly ripened they believe no difficulty will be experienced in churning it.

Investigations on the utilization of casein, Backhaus (*Ber. Landw. Inst. Univ. Königsberg, 2 (1897), pp. 1–11*).—The author points out that the fat of milk sells for about twice as much as the casein, although the relative nutritive value of fat to protein is given by König as 3:5 for human food and by Kühn as 2.5:6 for animal nutrition. The author believes that in the interest of dairying some means should be found for utilizing the casein more profitably. The uses to which casein has already been put in the industries and as a food for man and animals are noted.

The author made numerous investigations to find a practicable method by which the casein might be precipitated from milk and prepared commercially for food. The plan which he finally worked out consists in curdling the casein with rennet and converting the casein into a soluble form. It was found that the latter could be accomplished by adding certain salts to the casein, as trisodium citrate. Experiments showed 2.5 gm. of the citrate per liter of milk to be the best amount. The preparation was partially freed from water by pressing and then dried at a temperature of from 50 to 60° C., preferably in a vacuum or a well-ventilated oven. The final product is a white powder, nearly free from taste or odor, which dissolves in water, giving a cloudy solution. In order to prevent the solution from curdling on heating, the sodium citrate used in preparation may be made slightly alkaline, or about 10 per cent of carbonate of soda may be added to the salt. It was found in further experiments that the casein could be rendered soluble by rubbing the mixed precipitated casein with a mixture of 1.5 gm. of sodium citrate and 1 gm. of trisodium phosphate for each liter of milk originally taken.

The author believes the method is so simple that it may be employed at creameries without difficulty. An experiment on a large scale is to be undertaken, together with experiments on the use of the preparation of casein for cooking and for food.

Report of the milk-control station in Christiania, Norway, 1897 (*Norsk Landmansblad, 17 (1898), No. 3, p. 34*).—During 1897, 32,259 samples of milk, cream, skim milk, etc., were analyzed for fat content (by the De Laval butyrometer), 27,449 of these being samples of new milk. The average percentage of fat in the new milk was 3.467, against 3.44 per cent in 1895 and 3.461 per cent in 1896. The monthly averages in 1897, each of which include analyses of about 2,000 samples, ranged between 3.322 per cent (in April) and 3.745 per cent (in October).—F. W. WOLL.

Contribution to investigation on the addition of skim milk to whole milk, V. HOUDERT (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 294–298*).

A practical method for the preservation of milk samples for analysis—Analysis of curdled milk, P. DORNIC (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 75–81*).—Use of preservatives not recommended. Sample heated to boiling and tightly stoppered.

The use of acidimetry for testing milk which has soured or is in process of souring, P. DORNIC (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 82–86, dgm. 1*).

Indigo carmin as a means of testing fresh milk, L. VAUDIN (*Rev. Internat. Falsif., 11 (1898), No. 1, pp. 24, 25; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. 324*).

On the determination of fat in cream, butter, and cheese, N. GERBER and M. M. CRAANDIJK (*Milch Ztg., 27 (1898), No. 3, p. 35*).—Preliminary report of a modification of Gerber's method, by which reliable determinations of the fat in cream, butter, and cheese can be made.—F. W. WOLL.

Further remarks on the determination of the fat content of cream, N. GERBER and M. M. CRAANDIJK (*Milch Ztg., 27 (1898), No. 5, pp. 65, 66*).—Quotes largely from Farrington and Woll's book on "Testing Milk and Its Products," as to the sources of error in cream testing.—F. W. WOLL.

On the accuracy of centrifugal methods of fat determination for the examination of cream, H. SCHROTT (*Milch Ztg., 26 (1897), No. 52, p. 830*).—Dilution of cream with water or with skim milk of known fat content previous to the

analysis gives unsatisfactory results. The author recommends the construction of special test bottles for cream.—F. W. WOLL.

Determination of fat in cream by Gerber's acid-butyrometric method, M. SCHMOEGER (*Milch Ztg., 27 (1898), No. 3, pp. 33-35*).—The author calls attention to the possible error in the Gerber method arising from impure amyl alcohol, or from adding the acid and the amyl alcohol in other proportions than those given by the inventor. He shows that the method does not give reliable results with cream when tests are made according to Gerber's directions. By a modification proposed, viz, dilution of 1 part of cream with 2 parts of water and adding acid and amyl alcohol in the same proportions as in case of tests of whole milk, fairly satisfactory results were obtained. The difference between the results obtained by gravimetric analysis and by the modified method was within 0.5 per cent.—F. W. WOLL.

Centrifugal machines for the Gerber acid-butyrometric method (*Milch Ztg., 27 (1898), No. 1, pp. 6-7, figs. 4*).

The milk and butter supply of large cities, E. SAILLARD (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 42-57*).

Denmark's butter export, 1896-97, B. BOGGILD (*Tidsskr. Landökon, 16 (1897), No. 5-6, pp. 682-691*).—The exports of butter from Denmark during the year 1896-97 amounted to 140,889,000 lbs. avoirdupois against 134,570,000 during the preceding year. The excess of exports over imports was 101,530,000 lbs. against 99,294,000 lbs. in 1895-96. Of the butter exported 136,455,000 lbs. were sent to England, which is an increase of nearly 6,000,000 lbs. over the butter export to England during the preceding year.—F. W. WOLL.

The curdling power of the ferment of calves' rennet and test of antiseptic agents for preserving it, C. PETIT (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 39-41*).

Influence of the individuality of cows on the fat content of the milk, C. J. MARTIN (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 37, 38*).

The utilization of skim milk, buttermilk, and whey, C. J. MARTIN (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 31-36*).

On the sterilization and pasteurization of milk, L. L'HÔTE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 29, 30*).

Pure sterilized milk and its preservation in flasks which prevent the separation of butter, P. LAPEYRÈRE (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 299-304, figs. 4*).

The influence of food on production of milk by cows, HAGEMANN (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 235, 236*).

The bacteriology of cheese making, C. GORINI (*Bol. Not. Agr., 19 (1897), II, No. 28, pp. 388-396*).

VETERINARY SCIENCE AND PRACTICE.

On the results of the rinderpest investigations at Koch's experiment station in Kimberly (*Deut. Med. Wchnschr., 23 (1897), No. 50-51; abs. in Centbl. Bakt. u. Par., 1. Abt., 23 (1898), No. 8, pp. 337-341*).—The injection of gall was found to be ineffective. The immunizing power of the gall is attributed to chemical properties, which, contrary to Koch and Edington's experience, are weakened by the addition of glycerin. The use of gall is safe, since it causes no trouble even when mixed with the feed of the animals or dropped into their nostrils, nor are animals treated with it dangerous to other animals. Rinderpest generally spreads by natural infection. Cases of sickness following gall injection are attributed to previous infection.

Of 1,056 animals treated on 21 farms, 150 became diseased and 110 died; but of 587 injected animals none were lost. Another case cited shows a loss of 20 per cent of treated as compared with a loss of 82 per cent of untreated animals. Where herds were already infected deaths were most numerous. In one extreme case 114 animals out of 147 were lost. That no deaths can be attributed to the gall employed is shown by the fact that where the same gall was used animals were lost in some and not in other herds.

The immunity obtained by the injection of gall appears only some six days after the operation and is then of short duration. A serum obtained at the station has given much better results. With doses of 20 cc. or less, an animal in the first stages of rinderpest can be cured, while doses of 50 to 100 cc. has produced the same desirable effect in animals in all but the very last stages. Animals were treated with it which at intervals had received injections of virulent blood amounting to 50, 100, 200, 500, 2,000, 3,000, and 4,000 cc. A fever reaction of several days' duration followed treatment. A dose of 30 cc. of blood (equal to 20 cc. of serum) from such animals was found to protect others for two to three weeks. Of 24 noticeably diseased animals all were saved by such small doses, while 2 animals already diseased that had received 500 cc. of virulent blood were saved by a dose of 200 cc. of serum.

Comparing the results of the two methods and nontreatment, the case of a diseased herd where 85 animals had died is cited. The remainder (482) were inoculated with gall. Some four months later only 9 per cent had died. At this time, of 16 animals found to be diseased 1 was sacrificed, to make sure that rinderpest was being dealt with, and the remainder of the herd, including the 15 diseased, were treated with serum at the rate of 30 cc. per animal. All were saved. At another place, where 48 animals had been lost, only 16 of the remainder (76) were sound. Treatment with serum saved all but 7 already in a hopeless condition. At another farm 101 of 285 animals had died. Of the remainder 25 per cent were saved by serum injected at the same rate as in the former case. One herd of 376 had lost 4, and inoculations with serum at the rate of 20 cc. saved all but 16. In another herd of 472 animals, 166 had been lost. After treatment with serum only 46 died. According to Russian experience, immunity following natural infection lasts for about five years. At the Kimberly station immunity was obtained with gall for four months with glycerin and gall mixed in the proportion of 3 to 4 for ten to twenty days. This period of immunity was raised by following the treatment of gall by the injection of ½ to 1 cc. of virulent blood on one side of the animal and an injection of 10 to 20 or 30 cc. of serum on the other side. The places of injection, it is stated, should not be less than half a meter apart. Of 350 animals treated in this way only 5 per cent were lost.

Compared with other serums, diphtheria serum, for example, the

curative power of the Kimberly serum seems high. Doses of from 5 to 10 cc. of diphtheria serum are said to cure, but a dose of 10 cc. of the Kimberly serum has cured animals of 360 kg. weight when injected two days after infection. Calculated in weight, 1 gm. of the Kimberly serum is equal to 36,200 kg. of animal; or, considering only the chemical substances, the author gives the curative ratio analogously to that of the diphtheria serum of Brieger-Boer as 1 to 360,000,000.

How different the Kimberly serum is from the normal may be seen from the fact that 1,000 cc. of the latter will not protect an animal when injected twenty-four hours after the injection of ½ cc. of virulent blood. Whether the serum is antitoxic or microbicidal remains to be decided, though the authors suppose it may be microbicidal.

The sheep fluke, N. A. COBB (*Dept. Agr. New South Wales, Misc. Pub. 167, pp. 32, figs. 30, pl. 1*).—In this pamphlet there is given a popular account of the sheep fluke as it exists under Australian conditions, together with suggestions as to the methods of dealing with it.

In a study of the life history of the sheep fluke the cercaria of the latter were found, after long search, in the snail (*Bulimus brazieri*), a species entirely different from that serving as the intermediate host of the sheep fluke in Europe.

The author's remedial recommendations are all of a preventive sort. The burning of pasture lands it is thought may do some good, but the best methods are those of draining swampy lands, fencing them off so as to keep sheep away from them, or the formation of ditches or reservoirs for the collection of drinking water in such a way that it can not be contaminated by dung, and so become infected with the free swimming larvæ of the fluke. The rotation of stock upon pasture lands is also among the remedial measures recommended; that suggested as the best is sheep, horses, bullocks, horses, sheep.

A few notes are given on the Australian snail-eating birds, viz, the common mud lark, magpie lark or peewee (*Grallina picata*), pied grallina (*Grallina australis*), and the white fronted heron (*Ardeæ novæ-hollandiæ*).

Contribution to the natural history of Trichina spiralis, J. Y. GRAHAM (*Arch. Mikros. Anat., 50 (1897), No. 2, pp. 214–275, pls. 3; abs. in Zool. Centbl., 5 (1897), No. 2, pp. 47, 48*).—The author substantiates what has been observed several times heretofore, that the female deposits the brood not in the lumen of the intestine, but under the epithelium of the intestinal mucous membrane. The males are also found in the latter place. The young worms reach the lymph vessels and lymph glands, and then the *ductus thoracicus* of the blood vessels. When they reach the striated muscles they leave the blood capillaries and enter the muscle tissue. The penetration of the sarcolemma and the wandering about inside the muscle fibers, observed heretofore, is confirmed. If the trichina reach the cardiac muscle they perish. Their fate is the same also if they get into the pericardium or peritoneum. The author does not believe in the poisonous action of the worms. Two small

glands on the border of the oesophagus and the gut, which he calls chylestomachs, belong to the gut.

Tuberculosis in cattle and tuberculin, NOCARD (*Montargis, 1896; abs. in Arch. Wiss. u. Prakt. Thierheilkunde, Berlin, 22 (1897), No. 2–3, and in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 18–19, pp. 563–567*).—It is noted that in 1893, in the slaughterhouses of Prussia, out of 695,852 grown cattle, 62,312, or 8.9 per cent, were found tuberculous. At Berlin the percentage was 15.1 (in 1892, 12 per cent); at Magdeburg as high as 17.5 per cent. In the same year in Saxony of 69,164 animals, 12,630, or 18.26 per cent, were found diseased. At Amsterdam and Moscow the percentage was 5.5; in Mariland, 10 per cent; at Copenhagen, 17.7 per cent. These data are compared with French statistics taken in 1889. At Toulouse of 13,057 animals slaughtered, 1,254, or about 10 per cent, were tuberculous. In this year the law relative to the confiscation of animals affected with generalized tuberculosis went into effect and the number of tuberculous animals sank so that, of 12,694 animals, only 340 were found to be affected. For the same reason the number of such animals found at Bucharest sank to less than 3 per thousand. But when an indemnity was granted the owner of condemned animals the number suddenly increased to 30 per thousand.

In Great Britain, according to the author, the slaughterhouses are still in a rudimentary condition. The percentages mentioned are 12.5 in 1891 and 22.3 in 1892. The latter large percentage is attributed to slaughter of milch cows of London and Edinburgh.

In France certain regions, as Auvergne, Limousin, and the greater part of Normandy, are entirely free from the disease. For all France the percentage of tuberculous animals is placed at less than 1 per cent. But the statistics are not completely trustworthy and we must conclude that the disease is generally distributed.

The following increases are noted: Saxony, 1890–1893, 16.4 to 18.26 per cent; Berlin, 1891–92, 12 to 15.1 per cent; Leipsic, 1888–1893, 11.1 to 28.1 per cent; Schwerin, 1886–1894, 10.7 to 35 per cent.

The introduction of shorthorns in 1850 into Denmark is charged with raising the percentage there. By the use of tuberculin the percentage was raised from 17 per cent in 1893 to almost 40 per cent in 1894–95.

Other statistical facts of interest are that the author considers 4 to 5 per cent to represent the number of cattle with tuberculous udders. Also, that in a region where some 15 to 25 per cent of the cows were affected only 1 per thousand of tuberculous calves was found, and from other tuberculin studies where 40 to 80 per cent of the cattle were affected calves from 4 to 15 months old were not found diseased. Of 44 calves 6 to 18 months old, 33 were sound, and of the dams of these 26 were tuberculous. The sick were isolated from the sound, and repeated injections in 1893, 1894, and 1895 produced no reaction.

The author's conclusions are of considerable interest. Tuberculin injections can not produce the disease in sound animals; it is useless

only in the advanced stages of the disease, when the latter is readily recognized by other means. Other diseases, such as actinomycosis, verminous bronchitis, and echinococcus, do not cause a reaction unless accompanied with tuberculosis. But there is here a territory still open for investigation. Only 3 cases in 3,500 were found in which tuberculin injections appeared to hasten the disease; it has no influence on the bacillus in the milk. Only 5 per cent of the cases tested by the author refused to react to the second injection.

Relative to the assertion that reactions occur in sound animals, the author states that evidence of the disease is sometimes very difficult to find in post-mortem examinations, and cites the fact that at the congress of veterinarians in Bern two apparently sound animals reacted. One was killed and after a long search no traces of the disease found. This was thought to be evidence against the surety of the tuberculin. While others were occupied with the second animal the author made a further examination of the first, and was rewarded by finding a small lesion the size of a hazelnut near the bifurcation of the bronchi.

Pernicious and epizootic anemia of sheep, C. JULIEN (*Ann. Agron., 23 (1897), No. 12, pp. 575–588*).—The disease—attributed to *Strongylus contortus*—is generally distributed over France. There is noted a varietal as well as an individual resistance to it. Evidence of the disease appears in flocks of sheep in July or August or about the time for lamb weaning. The first infection seems attributable to weeds of low meadows that become contaminated by the droppings of the sheep and to water contaminated in the same way. The remedial measures noted are the raising of resistant varieties of sheep and the proscription of all sources of infection. Manures, litter, etc., may be treated with anthelmintic and the sheep given a mixture of 6 to 8 cc. benzin (5 to 6 cc. for lambs), and 15 to 20 centigrams of arsenious acid per head for some 8 days.

Echinococcus multilocularis in sheep, MOEBIUS (*Ztschr. Fleisch u. Milchhyg., 7, No. 6; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20–21, p. 619*).—One specimen was found in the lungs and five in the liver of a sheep. An Echinococcus was likewise found in a bronchial gland.

Injection experiments on calves with human tubercle bacillus, FROTHINGHAM (*Ztschr. Tiermed., 1 (1897), p. 330; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20–21, pp. 633, 634*).—It was endeavored to learn whether calves are less susceptible to human than to bovine tuberculosis. Of 4 calves injected with pure cultures of human tuberculosis, only 3 showed after death evidence of tuberculosis and in no case were the changes of great extent or a general infection such as was found in control guinea pigs. One calf escaped tuberculosis entirely.

Differential diagnosis of wandering trichina, GEORGES (*Ztschr. Fleisch u. Milchhyg., 7, No. 8; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20–21, p. 620*).—In a preparation of the striated muscle of a hog there were found between the fibers with only a magnification of 30 diameters round worms of the size and form of embryos of Strongylus. The worms were considered to be embryos of *Strongylus paradoxus*. They were distinguished from trichina by the bluntness of the oral end.

Strongylus paradoxus in the liver of the hog, W. SELLMAN (*Ztschr. Fleisch u. Milchhyg., 7, No. 10, p. 196; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20–21, p. 619*).—Numerous specimens were found in the gall ducts.

Texas fever, J. W. CONNAWAY (*Missouri Sta. Rpt. 1897, pp. 81–129, figs. 11*).—A reprint of Bulletin 37 of the station (E. S. R., 9, p. 188).

The cause and treatment of abortion in cows, J. SCHMIDT (*Tidsskr. Landökon., 16 (1897), No. 5–6, pp. 490–504*).

The disposal of the carcasses of dead animals, A. MOREL (*Des clos, d'équarrissage. Paris, 1897; rev. in Jour. Hyg., 23 (1898), No. 1123, p. 156*).—The need of inspection and precautionary measures is insisted upon, in the disposal of the carcasses of animals, to prevent the spread of diseases through the use of the flesh of diseased animals without properly sterilizing, and of the fat in manufacturing, etc.

TECHNOLOGY.

Analysis of molasses from beets and sugar cane—Determination of saccharose, raffinose, and invert sugar, S. DRACZKOWSKI (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 31–39*).

Analysis of molasses, C. LIESSE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 466–473*).

Analysis of commercial glucoses, H. PELLET (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 450–465*).

Analysis of commercial sugars, L. BEAUDET (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 23–30*).

Wine fermentation experiments in France, J. C. COVERT (*U. S. Consular Rpts., 1898, No. 210, pp. 411–414*).—Popular notes are given on the use of pure yeast cultures in the fermentation of wine must. Opinions are said to differ respecting the value of such ferments, but the majority of the evidence seems to go to prove the value of such methods in wine making.

The preparation of tannin extracts and the determination of their commercial value, F. JEAN (*2. Congrès Internat. Chim. Appl., 1896, III, pp. 91–93*).

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Louisiana Stations, 1897 (*Louisiana Stas. Rpt. 1897, pp. 12*).—A report on the operations of the Sugar Experiment Station at Audubon Park, New Orleans, the State Station at Baton Rouge, and the North Louisiana Station at Calhoun, with a list of the bulletins published during the year and the organization of each station. A financial statement is given for the fiscal year ending July 1, 1897, together with a subject list of the first and second series of station publications and of special bulletins issued. At the Sugar Experiment Station at Audubon Park sugar-cane seedling No. 74 grown for four years yielded in 1897 "over 40 tons per acre and with a mill extraction of 78 per cent; its juices had a density of 18° Brix. and polarized nearly 17 per cent sucrose." Alfalfa and velvet bean (*Dolichos multiflorus*) are reported as having given excellent yields at the same station.

Annual Report of Missouri Station for 1897 (*Missouri Sta. Rpt. 1897, pp. XV+209*).—Contains the financial report of the station for the fiscal year ending June 30, 1897; a report by the director reviewing in considerable detail the work of the station during the year, with notes on the station staff and a list of the publications of the station issued in 1897; and an appendix made up of reprints of bulletins 34–39 of the station and an index to the same.

Sixteenth Annual Report of Ohio Station, 1897 (*Ohio Sta. Bul. 84, pp. LXVII+402–408, fig. 1, dgm. 1*).—This contains the report of the director on the work of the station for the six months ending June 30, 1897; subject list of bulletins 75 to 84 of the station; acknowledgments; treasurer's report for the fiscal year ending June 30, 1897; text of the addresses delivered at the dedication of the station administration building June 3, 1897; and a general index covering the publications included in the tenth volume of the station work.

Spain's foreign trade, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 11, pp. 47*).—This details and analyzes the data bearing on Spain's foreign trade for the ten years ending with 1895, dealing with the extent of the land and sea commerce and the nature of the same; sources and value of imports, and destination and value of exports; the extent of imports and exports carried in national

and in foreign ships; the value of the trade with each of the principal countries of the world; data on the Spanish merchant marine, and on the vessels entering and clearing from the several customs districts of Spain, and tonnage of the same; and notes and data relative to the duties levied upon agricultural products imported from the different countries of the world.

Our trade with Spain, 1888–1897, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 12, pp. 47*).—A review and analysis of the commerce between Spain and the United States during the years 1888 to 1897, compiled largely from the United States Customs Reports, with tables showing in detail the quantities and value of the principal items of merchandise exported to and imported from that country during each of the ten years under consideration. The United States trade with Spain has decreased since 1883, when the combined imports and exports amounted to $24,725,632, to 1897, when the total trade amounted to but $14,541,718.

Final report on the crops of 1897, J. HYDE (*U. S. Dept. Agr., Division of Statistics Rpt. 155, n. ser., pp. 30*).—"A report on the area, production, and value of the principal agricultural products for 1897, together with the farm prices of such products on December 1 last and a meteorological record of the growing season."

The following table summarizes this data for the whole country:

Acreage, production, and value of the principal crops of the United States, in 1897.

Crop.	Acreage.	Yield per acre.	Production.	Price per bushel.[1]	Value.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	
Corn	80,095,051	23.8	1,902,967,933	26.3	$501,072,952
Wheat	39,465,066	13.4	530,149,168	80.8	428,547,121
Hay	42,426,770	[2] 1.43	[2] 60,664,876	[3] $6.62	401,390,728
Cotton	23,273,209	[4] .37	[4] 8,532,705	[5] 6.78	291,811,564
Oats	25,730,375	27.2	698,767,809	21.2	147,974,719
Potatoes	2,534,577	64.7	164,015,964	54.7	89,643,059
Barley	2,719,116	24.5	66,685,127	37.7	25,142,139
Rye	1,703,561	16.1	27,363,324	44.7	12,239,647
Buckwheat	717,836	20.9	14,997,451	42.1	6,319,188

[1] Average price December 1, 1897. [2] Tons. [3] Per ton. [4] Bales. [5] Per pound.

Of the cotton crop, 104,368 bales were sea-island cotton, valued at 14.36 cents per pound.

Natural resources of Asia Minor; its chief animals, plants, and minerals, K. KANNENBERG (*Kleinasiens Naturschätze, seine Tiere, Kulturpflanzen und Mineralschätze. Berlin, Gebrüder Borntraeger, 1897, pp. 278, pls. 31*).—This is written from an agricultural and an historical standpoint and considers both wild and domestic animals and plants. The peculiarities of the various domestic animals and something of their commercial importance and uses are brought out. Many of the wild animals, insects, etc., are only briefly noted. In some cases something of the folk-lore concerning them is given.

Possibilities of agriculture in the Yukon district, W. SAUNDERS (*Central Expt. Farm, Ottawa, Canada. Experimental Farm Notes, Feb. 1898, pp. 7*).—The author has compiled information relative to the climatic and meteorological conditions of the upper Yukon region and gives notes on the possibility of growing vegetables in the vicinity of Dawson. Notes are also given on the most northern points in Canadian territory where cereals have ripened.

Experiment station notes on miscellaneous subjects, J. H. WORST (*North Dakota Sta. Bul. 31, pp. 247–263*).—A popular bulletin "intended to be instructive on a number of subjects of every-day interest." The following topics are treated: Maintaining soil fertility, treatment of diseases of field crops, seed grain and methods of cultivation, trees and shrubbery for ornamental purposes, cultivation of small fruits, and organization of cooperative dairy associations.

The plow, cow, and steer (*Kansas State Bd. Agr. Quart. Rpt., 1898, Mar. 31, pp. 200*).—This popular, compiled report is "devoted to soil and crop culture as found

most suitable in Kansas, together with information as to better utilizing the cow and her products; the more profitable production of beef, wool, mutton, and poultry, and a higher order of home-making." The report also contains papers, addresses, and discussions at the twenty-seventh annual meeting of the board, January 12-14.

The potato and hay crops of 1897 (*Jour. Bd. Agr. [London], 4 (1898), No. 4, pp. 433-436*).—Statistics on these crops in Great Britain.

The rice crop of India, R. F. PATTERSON (*U. S. Consular Rpts., 1898, No. 210, p. 409*).—Statistical notes.

Sugar in British Guiana, A. J. PATTERSON (*U. S. Consular Rpts., 1898, No. 210, p. 408*).—A concise report on the sugar industry of British Guiana. It shows that there has been a continual decrease in the acreage of cane since 1892.

Wheat crop of India, 1897-98, R. F. PATTERSON (*U. S. Consular Rpts., 1898, No. 210, pp. 372, 373*).—Statistics concerning the production and exportation of Indian wheat.

List of officials and associations connected with the dairy interests in the United States and Canada for 1898 (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 22, pp. 8*).

Index to Iowa Station Bulletins 25 to 36 (*Iowa Sta. Bul. 36, pp. 879-889*).

Danish Agricultural Calendar, 1898, P. HOLT (*Lommebog for Landmänd. Copenhagen, 1897, pp. 396*).

Annual Report of the Royal Danish Agricultural Society, 1896-97 (*Copenhagen, 1897, pp. 166*).

Iceland's progress during the past twenty years, P. FEILBERG (*Tidsskr. Landökon., 16 (1897), No. 7-8, pp. 589-620*).

The influence of width of tire on draft of wagons, H. J. WATERS (*Missouri Sta. Rpt., 1897, pp. 165-206, figs. 14*).—A reprint of Bulletin 39 of the station (E. S. R., 9, p. 997).

The sewage farms of the city of Freiburg, in Baden, O. KORNE (*Arch. Hyg., 32 (1898), No. 3, pp. 173-219, pls. 3, dgm. 1*).—A chemical and bacteriological study of canals and sewage, with bibliography.

Report of the agricultural college at Aas, Norway, 1895-96, J. L. HIRCSH (*Ber. Höiere Landbr. Skole i Aas, 1895-96, pp. 331, pls. 6*).

Technical education in Austria (*U. S. Consular Rpts., 1897, Dec., pp. 543-550*).—Rise and development of technical schools in Austria.

Higher agricultural education in Denmark and Germany, J. SEBELIEN (*Ber. Höiere Landbr. Skole i Aas, 1895-96, pp. 125-212*).

Danish agricultural schools, T. FROST (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. 396-415*).

On the introduction of apprenticeships in agricultural and dairy instruction, A. GRANSTRÖM (*Biet [Helsingfors], 18 (1897), Nos. 3, pp. 85-94; 4, pp. 106-122*).

Danish agricultural institutions, N. HEYMAN (*Landbrugs-Institutioner. Copenhagen: Nordisk Forlag, 1897*).

Report of the agricultural department of Norway for 1896 (*Aarsber. Offent. Foranst. Landbr. Fremme, 1896, pp. LIX + 554*).

Agricultural school at Spalato, Dalmatia (*Ztschr. Nahr. Untersuch. u. Hyg., 11 (1897), No. 14, p. 245*).—An agricultural school is to be founded in Spalato, Dalmatia, with funds formerly given to the agricultural school in Gravosa, the latter being discontinued.

A brief handbook for apprentices on larger estates, A. V. TUXEN (*Kortfattet Vejledning for landväsenslärlinge paa större Gaarde. Copenhagen: Schubothe's Bogh., 1897, pp. 188*).

The biological annual, 1895, Y. DELAGE (*L'Année biologique, 1897, pp. XLVIII + 732*).—This publication is edited by Professor Delage, with the cooperation of a large number of well-known assistants. It is intended to give a review of all papers dealing with general biology.

NOTES.

ALABAMA COLLEGE STATION.—At the meeting of the board of trustees in June P. H. Mell was elected director of the station, and C. F. Baker, assistant zoologist, was given eighteen months' leave of absence, beginning January 1, 1899, to visit South America on a collecting expedition. Farmers' institutes were authorized under the control of the station council and Dr. C. A. Cary, veterinarian, was placed in charge of the work. An appropriation was made to defray expenses.

GEORGIA STATION.—The station has commenced to experiment this year in sugar-beet culture, and is continuing experiments on the use of lime upon dry and wet soils, the latter being first underdrained. On the dry soils so far no results are apparent from the use of lime applied last fall.

ILLINOIS STATION.—The station is cooperating with the Illinois State Sugar Beet Growers' Association, which was formed at the time of the sugar beet convention called by the station. Arrangements have been made for the publication of brief circulars upon various topics, issued in small numbers, and sent to the press of the State. These circulars serve sometimes to distribute information and sometimes to collect information from the people, and are proving of great value to the station work.

KENTUCKY STATION.—The board of control has been reorganized as follows: Chairman, Hart Boswell, Lexington; J. T. Gathright, Louisville; Thomas Todd, Shelbyville; James K. Patterson, Lexington, and secretary, M. A. Scovell, Lexington. A recent enactment of the legislature gives the station the supervision of the pure-food law of the State.

MAINE STATION.—The new poultry plant, consisting of a breeding house 150 ft. long and a winter brooding house 60 ft. long, was completely destroyed by fire May 18, involving a loss of about $1,500.

MARYLAND COLLEGE AND STATION.—H. J. Patterson has been elected director of the station, *vice* R. H. Miller, resigned. The State legislature has appropriated $14,000 for the erection of a Science Hall, to be used jointly by the college and station. It has also appropriated $10,000 for inaugurating State work in entomology and vegetable pathology, and provided for an annual appropriation hereafter of $8,000 for its maintenance. C. O. Townsend has been elected botanist and pathologist in the college and station and State pathologist.

NEW MEXICO STATION.—On June 17 the barn at the Las Vegas Substation was struck by lightning and completely destroyed, together with all its contents. The loss is estimated to be about $2,500, excluding about $600 worth of property belonging to the superintendent. The station carried an insurance of $1,500 on the barn and property.

NORTH CAROLINA STATION.—George S. Fraps, a graduate of North Carolina College of Agriculture and Mechanic Arts and of Johns Hopkins University, has been appointed assistant chemist of the station.

NORTH DAKOTA COLLEGE AND STATION.—The board of trustees of the North Dakota Agricultural College have decided to discontinue the dormitory system and convert

the boys' dormitory into laboratories and class and lecture rooms, which will largely increase the college facilities of every department, particularly those of agriculture, horticulture, and veterinary science.

OHIO STATION.—The General Assembly has appropriated the following funds for the support of the station for the two years 1898 and 1899: Expenses of board of control, $800; general repairs, labor, and supplies, $6,000; bulletin illustration, $900; substations for field experiments, $5,600; special work in entomology, botany, horticulture, and chemistry, $7,000; furniture and fixtures, $1,200; and investigation of tuberculosis, $1,000; making a total of $22,500.

OKLAHOMA STATION.—Oscar M. Morris, B. S., a graduate of the college in 1896, has been appointed assistant horticulturist, and A. G. Ford, B. S., a graduate of the college in 1898, has been appointed assistant in chemistry.

TEXAS COLLEGE.—L. L. Foster, of Velasco, has been elected president of the college. R. H. Whitlock, who has been acting president, will retire to the duties of professor of mechanical engineering.

UTAH COLLEGE AND STATION.—The following changes have been made in the governing board of the station: Allan M. Fleming, of Logan, has been elected treasurer, *vice* Ripley S. Lyon, resigned, and Mrs. R. N. Bagley, of Ogden, and Joseph Morrill, of Logan, have been appointed in place of John C. Graham and Clarissa S. McAlister. The other members of the board have been reappointed. Samuel Fortier, hydraulic engineer, has severed his connection with the station to accept the position of Superintendent of the Bear River Canal and Ogden Waterworks Company. George L. Swendsen, of the Brigham Young Academy, Logan, has been elected to succeed Professor Fortier. F. W. Brewer, biologist, has resigned his position in the college and station. The biological work of the station will be discontinued. W. S. Langton will next year assume charge of that department in the college.

WYOMING STATION.—During the year there have been constructed an addition to the greenhouse, 12 by 50 ft.; a small dwelling house upon the station farm, situated three miles from the university, and a small stable. The station is planning more extensive irrigation investigations than heretofore, and the results of a new alkali experiment are now ready for publication.

NECROLOGY.—Lyon Playfair died at London May 29, 1898, at the age of 79 years. He was one of the most prominent English scientists interested in agriculture, a pupil of Graham and later of Liebig. At one time he gave much attention to the problems of food and nutrition, his investigations in this line being of considerable importance. He was appointed professor of chemistry in the Royal Institution at Manchester in 1843. In 1844 Sir Robert Peel appointed Playfair on a commission to inquire into the sanitary condition of large towns. In 1856 he was appointed professor of chemistry at the University of Edinburgh and remained in this position for thirteen years. To him more than to any other is due the advance of technical education in England. He was actively engaged in the first and second great exhibitions in 1851 and 1862. He presided over many royal commissions and his great ability was generally recognized. He held many political positions, served in Parliament for a long period of years, and received the honor of a peerage. He was the last remaining original member of the London Chemical Society.

Osburt Salvin died at Hawksfold, near Haslemer, England, June 1, 1898, at the age of 63 years. He was a prominent ornithologist and entomologist and made many expeditions for collecting specimens, notably to Central America. In 1874 he accepted the office of the Strickland curatorship in the University of Cambridge, holding the position until 1883, when he resigned and, associated with Mr. Godwin, devoted himself to bringing out the "Biologia Centrali Americana." Alone or associated with others he was the author of some 124 scientific papers, among other work contributing Trochilidæ and Procellariidæ to the British Museum Catalogue of Birds.

EXPERIMENT STATION RECORD,

EDITED BY

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AND

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W. H. BEAL—Meteorology, Fertilizers (including methods of analysis), Soils, and Agricultural Engineering.
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C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
F. C. KENYON, PH. D.—Entomology and Veterinary Science.
R. A. EMERSON—Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

Vol. X. No. 2.

A recent communication from Mr. S. Machida, of Japan, contains some interesting information in relation to the status of the experiment station enterprise in his country. Mr. Machida was formerly connected with the station at Tokyo, but is now director of the recently established Tokai station, situated in Aichi.

The experiment stations in Japan are an outgrowth of the investigations and field experiments carried on in connection with the Imperial College of Agriculture at Tokyo. Their service to agriculture was recognized by Japanese agriculturists and created an int rest in agricultural experimentation, resulting in the establishment of agricultural institutions at Yokaichi and Kioto. In April, 1893, a bill passed the Japanese Parliament providing for the establishment of seven experiment stations under the control of the department of agriculture and commerce. These consist of a central station at Tokyo and six branch stations located by the minister of agriculture and commerce. These branch stations were located at Osaka, Miyagi, Ishikawa, Hiroshima, Tokushima, and Kumamoto. The work of these stations consists of tests of varieties of agricultural plants, selection of seed, tillage and culture, the use of fertilizers, soil investigations, harvesting and curing crops, agricultural technology, plant diseases and injurious insects, the protection of beneficial insects, feeding of farm animals, addressing farmers' meetings, distribution of seeds and plants, and analyses of miscellaneous materials sent in by farmers. The stations also answer questions propounded by farmers, make investigations of the present condition of Japanese agriculture, and publish records of the results of their work.

In 1896 three new stations were established on a much larger scale than the branch stations established in 1893. The locations of these stations are Aichi, Akita, and Shimane.

All of the stations, both old and new, are carrying out their work in accordance with the same general regulations and under the control of the central station, which is in charge of Mr. J. Sawano.

The Tokai station, located in Aichi, is a typical representative of the Japanese stations. It has a field of about 3.48 hectares ($8\frac{2}{3}$ acres), regular in form, with an irrigation ditch running through the center.

Originally the tract was very uneven, but it has been leveled off and made more suitable for experimental purposes and laid out into regular plats. It is now divided into four large portions. The land on one side of the irrigation ditch is paddy soil, and that on the other is dry land. In the "dry" field there are 198 plats, separated by a passage-way varying in breadth from 2 to 9 feet. The plats are connected with irrigation and drain ditches. The paddy field is divided into eight plats by roads and ditches, two ditches being used for irrigation and three for drainage. These plats can easily be temporarily subdivided into smaller ones. The station has been provided with eleven buildings used for office and laboratory purposes, storage, residences of officials and of workmen and servants, stables, etc.

The principal lines of work now in progress at the Tokai station are pot experiments on the availability of various forms of nitrogen and phosphoric acid to the rice plant; determination of the availability of nitrogen in organic nitrogenous fertilizers; influence of soil and manure upon rice; availability of natural sources of nutrients to different plants; effect of soil and fertilizers on the properties of the grain, straw, etc., of the rice plant; the effect of various forms of nitrogen on the production of indigotin in the leaves of *Polygonum tinctorium;* chemical investigations on the rice plant; the changes of coloring matter and composition of the indigo plant during its growth; the preparation of indigo and of dyestuffs from *Polygonum tinctorium*, and the chemical changes which take place during the process, and methods of analysis; various field experiments on paddy and upland rice—variety tests, use of seeds of different specific gravity, treatment of seed before sowing, time of sowing, distance, methods of manuring, etc.; variety tests of grasses and leguminous plants; variety, culture, and fertilizer experiments with sweet potatoes; variety, culture, and fertilizer tests with Japanese and upland cotton, and similar experiments with the indigo plant. In addition to the above, important investigations are being conducted in the chemical and microscopical laboratory.

The systematic organization of agricultural research in Japan is of especial interest at a time when this country is called upon to consider measures for the development of island regions where agriculture has hitherto been conducted in accordance with comparatively primitive methods. Evidently Japan has decided that the aid of science should be sought in a broad way to investigate the problems of her agriculture and has appreciated the fact that the progress of agriculture, as well as of other industries, depends very largely on scientific investigations and technical education. The Japanese experiment stations are attacking vital problems relating to the agriculture of that country, and the great usefulness of their work is illustrated by the publications which these stations have already issued. It is believed that we may learn much of value from this enterprise of the island empire of the East.

PHYSICAL AND METEOROLOGICAL RESEARCHES, PRINCIPALLY ON SOLAR RAYS, MADE AT THE STATION OF AGRICULTURAL CLIMATOLOGY AT THE OBSERVATORY OF JUVISY.

Camille Flammarion,
Director of the Station.

The purpose of the station of agricultural climatology is to study the sun's rays and their action upon the phenomena of plant growth. The observatory at Juvisy is constantly engaged in observing the sun and its changing surface. It measures the size of the sun spots and tries to fix the astronomical bases upon which rest the relations between the variations in terrestrial temperature and the source of all the heat and light of the earth. The station studies the absorption of heat and light rays by plants, and analyzes the action of the different colors of the solar spectrum. It observes also the different transformations of the energy of the sun on which depends so intimately the entire terrestrial life.

SOLAR RAYS AND THE DEVELOPMENT OF PLANTS.

Special attention has been given to the study of the peculiar action of the sun upon vegetation. The relative efficiency of the light rays, the heat rays, and the chemical rays has been studied. In this respect the slow rays of the extreme red of the spectrum differ widely from the rapid rays of the extreme violet. The rays which exercise the most favorable influence upon certain phenomena of vegetable life are readily investigated. For such investigations hothouses were built at the station. The glass used was subjected to a careful spectroscopic examination. Blue glass, approaching closely to violet, was obtained, which was only traversed by the rays of the extreme right of the spectrum. The red glass was almost monochromatic and was only traversed by a little orange. The green glass gave least satisfaction. The three hothouses were placed close together under the same meteorological conditions. Adjoining the houses which were covered with colored glass was an ordinary hothouse, for comparison, with full illumination. The houses were ventilated by a current of air passing from south to north through them, the object being to provide as nearly as possible natural conditions and to avoid overheating. The temperature of the air in the different hothouses was observed and the quantity of the sun's heat which traversed them was measured. The accompanying table

shows the temperatures observed in the different houses on August 20, 1895:

Temperature of interior of hothouses with white and colored glass.

Time of day.	White.	Red.	Green.	Blue.
	Deg. C.	*Deg. C.*	*Deg. C.*	*Deg. C*
7.30 a. m	32.0	31.0	30.7	29.5
8.30 a. m	40.0	39.5	37.0	35.0
10.30 a. m	49.0	46.0	41.5	40.0
12.30 p. m	42.0	40.0	39.0	38.0
2.30 p. m	41.0	40.5	40.3	40.2
4.30 p. m	30.0	30.0	30.0	30.0

From the above table it will be seen that the temperature of the hothouses decreased as the extreme right of the spectrum was approached. The temperature was the same in all the hothouses during cloudy days or when they did not receive the sun's rays directly. The decrease of the temperature in the blue house, as compared with the white, is explained by the fact that the absorptive power of the glass of the hothouses increased as the violet extremity of the spectrum was approached. The ability to absorb the sun's rays determines the heat in the hothouses. All rays traverse the white glass, and it is therefore in this house that the highest temperature was found. On the other hand, blue glass has the greatest absorbing power, and the hothouse covered with blue glass had therefore the lowest temperature.

In 1895 sensitive plants, grown from the same lot of seed and equally vigorous, were placed in each hothouse. Their height at that time was 0.027 meter. The plant placed in the red house developed extraordinarily and attained a size fifteen times as great as that in the blue house, where the plants remained nearly stationary. The red light produced the effect of a chemical fertilizer, although in this case actinic rays were absent. These plants were all equally cared for. The sensitiveness of the plant grown in the red house had attained such a degree that the slightest movement or breath was sufficient to cause the closing of the leaflets and the drooping of the pedicels. The sensitiveness diminished under the white or green color, while under the blue light the plant was almost insensitive. The plant in the red house blossomed September 24. In the white house it increased in stockiness and was very vigorous but did not increase in height. It showed flower buds, but they did not open. The plant under the red glass had a lighter-colored foliage than that under the white. The foliage was paler than that under the green, while the blue was much darker. The difference of the temperature between the hothouses was not very great. There were, nevertheless, several degrees difference between the white and the blue. The intensity of illumination decreased in the same proportion as the temperature rose. The height of the plants in the different houses after an experiment of 3 months was relatively as follows: Blue hothouse, 0.027 meter; white hothouse, 0.1 meter; green hothouse, 0.152 meter, and red hothouse, 0.42 meter.

A photograph taken October 22 shows at a glance the influence of different solar rays (fig. 2). The difference observed might have several causes, viz: (1) The difference in the solar rays admitted; (2) difference in temperature which, compared with that in the white house, was lowest in the blue and highest in the red house; (3) difference in the amount of light, the intensity of which was greatest in the white hothouse and least in the blue; and (4) to difference in humidity of the soil and the air, which was lowest in the white hothouse and highest in the blue.

It would be interesting to know whether the results obtained are due to these differences. If the differences depend upon temperature, they would differ according to the seasons. In the spring the temperature of the hothouses during daytime remains below the optimum for the growth of plants. The amount of growth, therefore, would follow in this order: White, red, green, and blue; and during the summer, when the temperature often surpasses the optimum for plant growth, the maximum of growth would occur in the inverse order, namely: Blue, green, red, and white. The blue hothouse, the temperature of which is nearest the optimum, should favor the greatest growth. On the contrary, the results obtained in the different houses were absolutely identical in spring and summer, notwithstanding the difference in temperature. The greatest development was always produced in the red hothouse, and the minimum in the blue, where there was almost no growth. The results indicate that the inequality in growth is not due to differences in temperature. The sensitive plant in the white hothouse owes its feeble growth to the combined action of excessive light and temperature.

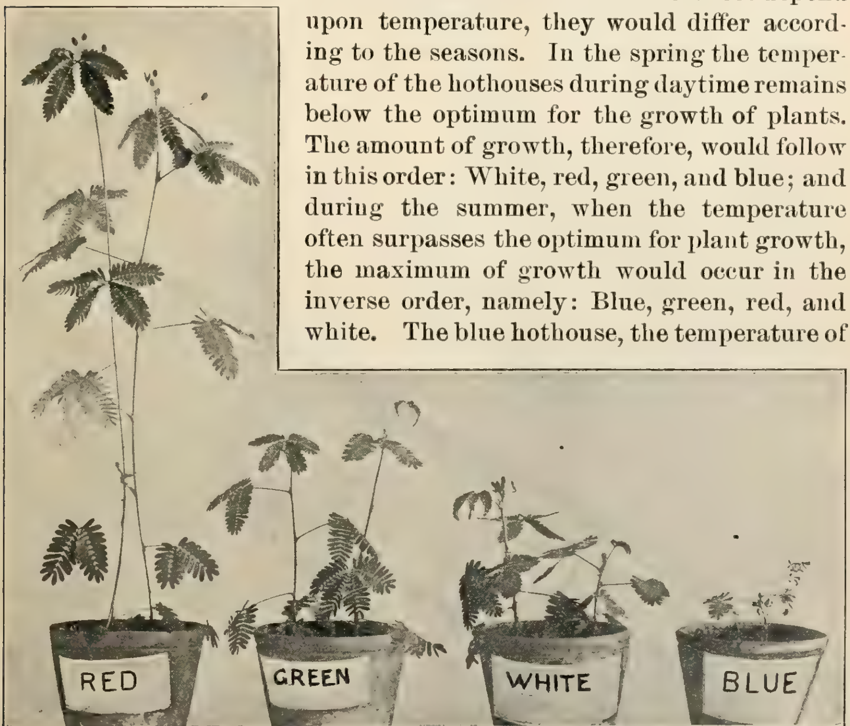

FIG. 2.—Sensitive plants grown in different colored light.

In 1896 experiments were begun to compare the development of

plants in white and red light under the same temperature and the same intensity of light. The same temperature was obtained in the different houses by means of screens of loosely woven white linen, which allowed only a limited passage of the sun's rays but which did not alter the quality of the rays. The subjects of the experiments were sensitive plants, maize, peas, beans, lettuce, strawberries, fig-trees, Achyrantha, Perilla, Coleus, Strobilanthes, Tradescantia, grapes, etc. Some of the most interesting results are appended. On June 13 three pots of equally vigorous sensitive plants, 0.03 meter in height, were placed in each hothouse. Their increase in height at different dates is shown in the following table:

Height of sensitive plants in different colored hothouses.

Date.	Red.	White.	Green.	Blue.
	Meter.	*Meter.*	*Meter.*	*Meter.*
June 13	0.030	0.030	0.030	0.030
July 22	.230	.120	.080	.035
August 16	.380	.240	.100	.035
August 30	.470	.270	.100	.035
October 12	.500	.280	.100	.035

The sensitive plant in the red hothouse attained a greater height and was more sensitive than that in the white hothouse, and its vegetative development was more advanced. It began to bloom October 1, while the plant in the white hothouse began October 12. The sensitive plant in the green hothouse remained almost at a standstill, became etiolated and, the nutrition becoming insufficient, the plant ceased to grow. The plants in the white hothouse, grown under the same conditions of temperature, moisture, and illumination as those of the red hothouse, attained a height of only

FIG. 3.—Sensitive plants grown at the same temperature in different colored light.

0.28 meter, while those in the red hothouse reached 0.5 meter. A photograph taken October 12, 1896 (fig. 3), shows the differences in growth under similar temperatures. It will be noticed that the sensitive plant in the white hothouse had gained in stockiness what it had lost in height. Indeed, the diameter of the stem and the surface of the leaves were larger in the plants in the white hothouse than in those in the red. The weight of the above-ground part of the plants of the different hothouses was as follows:

Effect of different colored lights on the weight of sensitive plants.

Hothouse.	Weight of stems and leaves.	Weight of an average leaf.	Diameter of stem.
	Grams.	*Gram.*	*Mm.*
White	8.400	0.600	3.0
Red	4.600	.250	2.0
Green	.300	.150	1.5
Blue	.150	.095	1.0

It will be seen that, notwithstanding the great height of the sensitive plant grown under red glass, its weight is about half that of the plant grown in the white hothouse.

In experiments with other plants results were obtained which differed somewhat according to the species. The results with *Strobilanthes dyerianus* agreed entirely with those for the sensitive plant.

Young summer lettuce was placed in different hothouses during June and July. The results in the white hothouse and in the open air were identical. The leaves were large, thick, of a reddish-brown color, and formed a well-rounded head. The lettuce in the red house was drawn, the leaves were long and straight, blanched, drooping, and widely separated by long internodes. The plants in the green house increased in height a little, while the leaves were less curled than those in the red house. The lettuce in the blue house added only a few leaves, without growing at all in height. The height attained by the different plants was as follows: In the red house, 1.5 meters; in the white, 0.6 meter; in the green, 0.4 meter; in the blue, 0.1 meter. The lettuce in the red house bloomed 15 days earlier than that in the white house. Figure 4 (p. 108) shows these differences.

In the experiment with maize, young stalks measuring 0.15 meter in height were set out in the hothouses in May. They were measured July 22 with the following results: In the white hothouse, 1 meter; in the red, 0.4 meter; in the green, 0.2 meter; in the blue, 0.15 meter. These results differ from those observed in the case of the sensitive plants in that the development of maize was less in the red hothouse than in the white.

In the experiments with peas and beans the most vigorous growth occurred in the white hothouse. There was less development in the red, and the minimum of growth was obtained in the blue hothouse.

The beans bloomed and fruited in the white as well as in the red hothouse, but perished in the green and blue. Peas bloomed in all hothouses except the blue, where the plant did not grow any during the two months of the experiment. The peas in the green house remained in bloom for three weeks without fruiting. Only those in the red and white houses fruited.

The following assortment of vines was placed in each of the hothouses: One of Chasselas, two of Frankenthal, and two of Mélinet. The Chasselas, and one vine of Frankenthal, were planted in 1894, the vines of Frankenthal and Mélinet, in 1895. Beginning with April 10, a differ-

FIG. 4.—Lettuce plants grown in different colored light.

ence in development could be noticed, due to the unequal temperature of the hothouses. The vines in the white and red houses started earliest. The growth of stem and number of leaves of a Mélinet in the different houses (May 10) is given below:

Growth of grapevines under colored glass.

Hothouse.	First branch.	Second branch.	Third branch.	Number of leaves.
	Meter.	*Meter.*	*Meter.*	
Red	0.80	0.83	....	16
Green	.48	.02	....	8
Blue	.50	.45	0.18	16
White	.20	.20	....	12

The results with the Frankenthal were absolutely the same. There was an extraordinary development of branches in the red house, surpassing the white in this respect. This difference was greatly increased by pinching off the branches. The plants in the green light soon stopped growing and made only a few new leaves. The plants in the blue house continued to grow slowly. To recapitulate: The vine in the white house grew but slowly; its wood was well developed; it remained short and vigorous during the entire season. The vine in the red house grew in length, but lost much in vigor; its numerous branches had frequently to be pinched back, and its foliage was but little colored. The vine in the blue house grew slowly, considering the rapid start made; it remained vigorous with large dark-green leaves. One-year-old vines behaved in the same manner; the vines in the white hothouse were vigorous and developed a more luxuriant growth than those in the other houses. In general, the phenomena in case of the grapes were similar to those observed in the case of sensitive plants. However, the blue rays were not so unfavorable to the development of the vine as they were for other plants. The experiments with vines were concerned only with the vegetative growth, and not with the fruiting.

The development of Perilla was intense in the white and red houses, the plants in the white surpassing in vigor those in the red. The plants in the green house changed little during the experiments, while those in the blue remained inactive.

Experiments with Coleus showed little difference in growth. The plant in the white hothouse spread and made a magnificent ornamental plant. That in the red house, while showing less foliage, increased in height. In the green and white houses there was very little development.

The results with Achyrantha accord with those for the sensitive plant. The plant in the red house grew so much in length that its branches could hardly hold up.

Three young potted strawberry plants of the same age and vigor were placed in each hothouse in May. In June the plants fruited with the following result:

Effect of different colored light on fruiting of strawberries.

	Number of fruits.	Total weight of fruit.	Average weight of fruit.
		Grams.	*Gram.*
In the open air	70	46.40	0.66
In white hothouse	73	46.80	.64
In red hothouse	25	9.80	.39
In green hothouse	12	4.20	.35
In blue hothouse	5	1.80	.36

Only the plants in the white hothouse and those in the open air produced any considerable number of fruits. The plants receiving the total radiation yielded five times as many fruits as those which grew

under the red light. Those in the green hothouse yielded about one-tenth as much as those in the white. The weight of the fruits from the blue hothouse was insignificant. The strawberries which received only colored light were very watery and insipid. Their average weight was half that of those which had received the total radiation.

The different rays of the solar spectrum modify not only the above-ground growth of plants, but also affect the entire vegetative part of the plant. The root system of the young plants which had been grown in hothouses was poorly developed. It was greatly reduced in the red house, and in the blue there was almost no root system. The weight of the roots of the sensitive plants in the different houses, October 13, was as follows: In the white house, 5 gm.; in the red, 1.6 gm.; in the green, 0.09 gm.; in the blue, 0.05 gm.

The nutrition of the plant is to a great extent dependent upon the root system. It is partly due to this dependence that the plants in the red, blue, and green houses had so little vigor. It is well known that the red and orange portions of the spectrum favor assimilation, transpiration, and respiration of plants. The natural result of this is an increase in the vegetative activity and in the function of nutrition. It is evident, therefore, that differences of growth, vegetative activity, vigor, development, sensitiveness, and coloration of plants result from differences in radiation. Microscopic examination of sections of the sensitive plant showed that the anatomical structure and the diameter of the plants in the red and white houses differed. The epidermis was thicker, and the woody fibers of the stem were more numerous in the plant in the white hothouse, the pith was much less developed, the cells were better formed, and the partitions thicker.

Notwithstanding the great care which was taken in conducting these experiments, it was very difficult to avoid all sources of error. Glass considered monochromatic for the red as well as for blue proved unsatisfactory for the reason that some yellow rays passed through them. In further study of this subject, experiments were conducted in which the three different colors were obtained from the spectrum derived from a prism.

Plants were placed in the different regions of the solar or electric spectrum and the modifications due to different rays thus observed. For this purpose a prism was constructed capable of giving a spectrum of great dimensions, and in which could be placed such liquids as carbon bisulphid and spirits of turpentine, the refractive power of which is very high. The source of light was an electric arc lamp. The use of carbon bisulphid was discontinued on account of its volatility and excessive inflammability, and as a substitute spirits of turpentine, the refracting power of which is far less, was used. The index of refraction for spirits of turpentine is 1.470496 for the red and 1.493874 for the violet. The difference in dispersion of the two is, therefore, 0.023378. A straight slit was placed against the prism filled with turpentine and

a convex lens placed between the prism and the arc lamp. These were placed at a distance from the prism equal to double that of the focus of the lens The prism was placed in the position of least deviation to the spirits of turpentine, which was in this case 30°. The spectrum reflected upon a screen 3 meters from the prism measured about 25 cm. (nearly 10 in.) in length. The arc light gave a constant intensity of 10 amperes and burned twenty hours daily. Notwithstanding the limited size of the spectrum a series of experiments was started, which permitted the verification of the results obtained in the colored hothouses. These experiments were on the growth of flax and vetches, and on the transpiration of leaves.

August 25 a small box of flax was exposed to the luminous region of the spectrum. The plants had sprouted and reached a height of 0.04 meter, and the cotyledons were slightly expanded. On August 27 the first leaves were beginning to expand in the red portion of the spectrum, and some leaves appeared in the yellow, but no change was observed at the right end of the spectrum. On September 4, ten days after the beginning of the experiments, the box with the plants was photographed and the plants were measured. In the red light the stems had attained a height of 0.085 meter, and in the blue 0.040 meter.

The temperature remained the same for all plants during the time of experiment; it varied between 10° and 30°, with an average temperature for the ten days of 18° C. On account of great difficulties encountered the experiments had to be discontinued. They were continued far enough to verify the favorable action of the red rays upon the growth of plants. This favorable action seems to be due partly to the infra-red rays. The pure green of the spectrum was very small, and on this account plants exposed to green rays received some yellow rays. The use of carbon bisulphid would have provided a more extensive spectrum.

The common vetch (*Vicia communis*) is very sensitive to light, and grows very rapidly under a weak illumination. Pots of three plants each were placed in different portions of the spectrum and separated by small black screens At the commencement of the experiment their height was 0.04 meter. The average height of the plants in each pot August 15 was as follows: Red 0.09, yellow 0.08, green 0.05, violet 0.07; and August 20, red 0.21, yellow 0.185, green 0.16, violet 0.15 meter. As in the other cases, the maximum growth took place in the red portion of the spectrum, the results obtained with the spectrum of the electric light and in the hothouses with colored glasses agreeing.

EFFECT OF WHITE AND COLORED LIGHT ON TRANSPIRATION.

In the course of the above experiments the transpiration of the leaves under different rays of the spectrum was measured. It was found that grapevines attained the maximum of transpiration in white light, there being a decrease from red to blue. An experiment on leaves of maize exposed to different regions of the luminous electric spectrum gave

more definite results. The maize plants were fifteen days old; the stems were equally vigorous, and each bore five leaves. The experiment was begun September 14, with an average temperature of 20° C., and each leaf was inclosed in a glass tube. The experiment lasted 26 hours, and the transpired water was as follows:

Effect of different colors on transpiration of maize.

Color.	Weight of leaf.	Weight of transpired water.	Water transpired per gram of leaf.
	Gram.	*Gram.*	*Grams.*
Red	0.135	0.208	1.540
Yellow	.102	.230	2.254
Green with some yellow rays	.095	.065	.682
Violet	.080	.024	.302

It will be seen that the maximum transpiration occurred in the orange-yellow and the minimum in the violet portion of the spectrum.

ACTION OF DIFFERENT PORTIONS OF THE SPECTRUM ON THE COLOR OF VEGETABLE TISSUES.

The many different colors of plants are mostly due to light. The green color of the leaves, due to chlorophyll, can only be produced in the light. The blue, yellow, red, and other colors are partly due to pigments and partly to cell sap. The writer has investigated the rôle of light in the coloration of the different tissues of flowers, fruits, etc.

For these researches colored-glass hothouses and absolutely monochromatic solutions were used. The solutions were contained between the walls of special vessels in the interior of which the flowers, fruits, leaves, etc., were exposed. The red was obtained from a solution of carmin in ammonia, the green from a concentrated solution of copper chlorid, and the blue from a solution of copper sulphate and ammonia. According to Sachs, the development of the coloring matter is independent of the action of light. It is developed in the leaves at the expense of substances which are produced under the action of light. The author's experiments indicate that light acts not only on the nutrition of the plant, but also on the coloring of the tissues. It sometimes exerts a direct action on the flower, and in this case the coloring is due principally to light.

Plants may be classified according to the cause of coloration into three groups, namely, those in which coloration is due (1) to the direct action of light, (2) to the action of the light and to the food material in the leaves, and (3) to other causes than the action of light. Chlorophyll is directly due to the action of light. It is not immediately destroyed when the plant is placed in darkness, but remains unchanged as long as the plant has not exhausted its reserve, disappearing only when the reserve material has been exhausted. Observations on

ACTION OF DIFFERENT LIGHT RAYS ON COLEUS LEAVES.

A, full radiation; B, red rays; C, green rays; D, blue rays; E, open air; F, subdued light; G, diffused light; H, very dim light.

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flowers are to the same effect. It has been known for some time that to obtain white lilacs it is only necessary to place colored lilacs, especially the Marly variety, in a hothouse kept at a constant temperature of 15° C. Duchartre states that the lilac would become white if placed in a very light hothouse if the temperature remained constantly at 15° C. He attributes the decoloration of the flowers to the more energetic oxidation of the air of the hothouse.

The experiments of the author were conducted on Marly and Persian lilacs, planted in colored hothouses and in the open air. The panicles were budded and at the time of planting were slightly colored. In the white hothouse the lilacs became pink and almost entirely lost their color. In the red, green, and blue houses they become absolutely white. The hothouses had a varying temperature, during the night falling to 1° and rising during the day to 25°. Lilac buds inclosed in a dark hood become discolored notwithstanding the temperature was the same as in the surrounding air. If the panicles were inclosed when already more or less colored red shades were obtained. Thus it is possible to obtain on one stem flowers of all shades between the white and violet red. If panicles already colored are placed under a colored bell jar, flowers varying from pale blue to clear red violet will be obtained. These results are neither due to temperature nor to activity of growth, but are evidently caused by differences in light.

The writer's experiments covered a great number of plants, and it was found possible to change the form, size, and color of the leaves of plants with different colored light. Among the most remarkable results were those obtained with the Coleus. In the accompanying plate some of the differences observed on this plant due to its culture, character of solar rays, or the different intensity of light are shown.

In Plate I, A represents a leaf exposed to full radiation in the white hothouse, and B one grown in the red hothouse. It can be seen that the red pigment decreased in red light, the leaf spread, and its form changed. Leaf C, grown under the green-colored glass, is diminished in size, the red pigment has disappeared, being replaced by a yellow coloration. In leaf D, grown in blue rays, the red pigment has almost completely disappeared. On the same plate are also shown four other leaves of Coleus, the first grown in the open air, the second under a slightly diffused light through a garden frame, the third in diffused light, and the fourth under a still weaker light. The transformation of the plant in this case is gradually accomplished under an attenuation of light, as in the preceding case under the influence of different rays. The largest and most curious leaf is the third. The fourth was greatly diminished and modified, having changed from poppy red with a dark edge to yellow and light green.

Comparing these eight Coleus leaves it will be seen that the leaf from the hothouse under total radiation has developed much more than the one grown in the open air; that those from the red house and diffused

light show increased size and a particular coloring; and that those from the green and blue hothouses and under very feeble light have lost almost all their resemblance to the normal leaf. These experiments establish the fact that light, without the aid of any other factors, is able to modify plants.

Results not less curious have been obtained with other plants, some of which are shown in the colored plate (Pl. II). The red-flowered crassula was placed in the dark at a time when its buds were only slightly colored. It shows only a narrow, colored edge bordering a white flower. The purple leaves of *Alternanthera amena* became absolutely green under the red glass. Geranium leaves lost their reddish-brown tone and changed under the red, blue, and green rays into the three following forms: In the red hothouse they were large, well cut, and pale green; in the blue, almost round and dark green; in the green, small and very pale green. Similar experiments were made with fruits by surrounding the branches with colored glasses. The same results as indicated above were produced with peaches, apples, cherries, and strawberries. In certain plants the leucites, to which their coloration is due, act according to the way in which they receive the light. Others vary under the influence of light in combination with the plant's nutrition. Still others are altogether insensible to the action of light. To the last class belong carrots, beets, radishes, potatoes, truffles, etc., the underground colorations of which are evidently independent of light.

[Concluded in next number.]

ACTION OF DIFFERENT LIGHT RAYS ON THE COLORATION OF PLANTS.

1, Red-flowered crassula: (A) in sunlight; (B) in darkness. 2, *Alternanthera amœna:* (C) full radiation; (D) red rays. 3, Geranium leaves; (E) full radiation; (F) blue rays; (G) green rays; (H) red rays.

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RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Sulphuric acid as a reagent in the analysis of fatty acids, E. TWITCHELL (*Jour. Soc. Chem. Ind., 16 (1897), No. 14, pp. 1002–1004*).—The reaction between concentrated sulphuric acid and any fat involves chiefly the unsaturated fatty acids of the fat and consists primarily of the addition of sulphuric acid to the unsaturated carbon atoms of these acids. On this assumption the author concluded that a separation of the unsaturated oleic, linoleic, and linolenic acids from the unattacked saturated palmitic and stearic acids could be made and possibly a difference in the action of sulphuric acid in the different members of the group of unsaturated acids might then be shown. The following tentative method was adopted: Weigh from 0.5 to 1 gm. of the fatty acid in a glass-stoppered Erlenmeyer flask; melt and allow to solidify in as thin a layer over the bottom as possible. On the layer pour about 3 cc. of 85 per cent of sulphuric acid. There is usually no combination until the flask has been slightly warmed. At a certain temperature the combination takes place very rapidly and forms a clear solution. When this occurs the flask is quickly cooled, 50 cc. of petroleum ether added, the stopper inserted, and the flask shaken violently for a minute or two, then allowed to settle and the petroleum ether decanted. The flask is rinsed twice with 10 cc. of petroleum ether, the washings added to the first extract, and the whole poured into a separatory funnel and washed once or twice with water. The petroleum ether is then evaporated, and the residue, consisting of the saturated fatty acids, is weighed.—J. P. STREET.

Needed reform in the analytical methods for fodders and feeds, E. SCHULZE (*Landw. Vers. Stat., 49 (1898), No. 6, pp. 419–441*).—The author calls attention to the impurity of the ether extract obtained from feeds in the ordinary analysis and the inaccuracy of the methods for crude fiber. None of the present methods for fiber are accurate for all classes of fodders and feeds. He suggests that after the material is dried and finely pulverized it be extracted with ether, alcohol, malt extract, and water. This will bring into solution the fats, lecithin, soluble carbohydrates, starches, amids, soluble proteids, etc. The insoluble residue will consist of the insoluble proteids, the cell walls, and a part of the ash constituents. By determining and deducting

the ash and protein content of this residue there would remain the nitrogen-free material insoluble in the above-named solvents. The method as suggested is simpler and easier of manipulation than that suggested by König.[1]—J. P. STREET.

Report of the chemist, R. C. KEDZIE (*Michigan Sta. Rpt. 1896, pp. 128–131*).—A general summary of the work of the chemical department during 1896, including more detailed notes on the ash of epiphytes (noted elsewhere) and the danger resulting from the use of Paris green against insects on peppermint. A chemical examination of the oil distilled from peppermint plants sprayed with Paris green gave distinct reactions for arsenic.

Report of the agricultural chemical laboratory at Helsingfors, Finland, for 1895 (*Landtbr. Styr. Meddel., 1897, No. 19, pp. 130–139*).

On E. Salkowski's investigations on the effect of heating albumen in water under pressure, R. NEUMEISTER (*Ztschr. Biol., 36, No. 3, pp. 420–424*).—This is a controversial article.

The cleavage products of albumin, I, O. FOLIN (*Ztschr. Physiol. Chem., 25, No. 1–2, pp. 152–164*).

Contribution to the study of the albuminoids of flour of legumes and cereals, E. FLEURENT (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 19, pp. 1374–1377*).—According to the author, bean flour contains 31.04 per cent total nitrogenous material, made up of 18.92 per cent legumin, 0.2 per cent albumin, and 11.92 per cent gluten. The gluten consists of 9.52 per cent glutenin and 2.40 gliadin. The so-called vegetable casein is regarded as legumin and glutenin and vegetable fibrin as albumin and gliadin. The properties of nitrogenous constituents are briefly discussed, as well as the use of bean flour with wheat flour for bread making.

The occurrence of glutamin in plants, E. SCHULZE (*Landw. Vers. Stat., 49 (1898), No. 6, pp. 442–446*).

The chemical structure of galactose, A. WOHL and E. LIST (*Ber. Deut. Chem. Gesell., 30 (1897), No. 19, pp. 3101–3108*).

The classification of the proteids, A. WRÓBLEWSKI (*Ber. Deut. Chem. Gesell., 30 (1897), No. 19, pp. 3045–3053*).

The optical properties of tannin, P. WALDEN (*Ber. Deut. Chem. Gesell., 30 (1897), No. 19, pp. 3151–3157*).

The effect of different temperatures in the extraction of tanning materials, J. G. PARKER (*Jour. Soc. Chem. Ind., 17 (1898), No. 2, pp. 106–110.*)

Studies on the determination of tannin, E. AGLOT (*Ztschr. Angew. Chem., 1898, No. 8, pp. 181–183*).

Standard methods for the sampling and analysis of tanning materials (*Jour. Soc. Chem. Ind., 17 (1898), No. 1, pp. 6–10*).—A report on the recommendations of the international conference of leather-trades chemists held in London September, 1897. Methods for sampling and chemical analysis are recommended for trial until the next conference, to be held in Vienna in July of this year.—J. P. STREET.

Further contributions to the chemistry of protein precipitation, H. SCHJERNING (*Ztschr. Analyt. Chem., 37 (1898), No. 2, pp. 73–87*).

Commercial analysis of starches, L. LAZE (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 27, 28*).

On the saccharification of starch by the amylase of malt, H. POTTEVIN (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 17, pp. 1218–1221*).

Spirits from cellulose and wood, E. SIMONSEN (*Ztschr. Angew. Chem., 1898, Nos. 9, pp. 195, 196; 10, pp. 219–228*).

Introduction to the study of the alkaloids, with special reference to the vegetable alkaloids and ptomaines, I. GUARESCHI (*Einführung in das Studium der*

[1] Landw. Vers. Stat., 48 (1897), pp. 81–110; Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 1, p. 3 (E. S. R., 9, p. 1021).

Alkaloide, etc. Berlin, 1896–97, pts. 2, pp. VII + 304–657).—German translation by H. Kunz-Krause with author's cooperation.

The lecithins of sugar cane, E. C. SHOREY (*Jour. Amer. Chem. Soc., 20 (1898), No. 2, pp. 113–118*).

Additional notes on the sugar-cane amid, E. C. SHOREY (*Jour. Amer. Chem. Soc., 20 (1898), No. 2, pp. 133–137*).

Study on the reducing sugar in 13 varieties of corn, C. ISTRATI and G. ŒTTINGER (*Bul. Soc. Sci. Bucharest, 1897, p. 516; abs. in Bul. Soc. Chim. Paris, 3. ser., 20 (1898), No. 8, p. 368*).—This is a study of the sugar content of the green stalks of maize with a view to their utilization in sugar making.

The estimation of sugar by electrical methods, J. FORMÁNEK (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 5, pp. 320–322*).

A new titration method for the determination of glucose, lactose, and other reducing bodies by Fehling's solution, E. RIEGLER (*Ztschr. Analyt. Chem., 37 (1898), No. 1, pp. 22–25*).

The determination of sugar and the polarimetric examination of sweet wines, A. BORNTRAGER (*Ztschr. Analyt. Chem., 37 (1898), No. 3, pp. 145–172*).

Clerget's method of estimating cane sugar, A. R. LING (*Jour. Soc. Chem. Ind., 17 (1898), No. 2, pp. 110, 111*).

Note on the estimation of moisture in invert sugar, L. T. THORNE and E. H. JEFFERS (*Jour. Soc. Chem. Ind., 17 (1898), No. 2, pp. 114–116, fig. 1*).

The action of subacetate of lead and of neutral acetate of lead on solutions of lactose. Determination of saccharose in the presence of lactose and of glucose. Determination of saccharose and of lactose in condensed milks, H. PELLET (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 427–432*).

On the methods for determining the fineness of flours, V. VEDRÖDI (*Ztschr. Analyt. Chem., 37 (1898), No. 2, pp. 87–92*).

The determination of phosphoric acid by titration, A. HEBEBRAND (*Ztschr. Analyt. Chem., 37 (1898), No. 4, pp. 217–233*).—The ammonium-magnesium phosphate obtained in the usual manner is thrown upon a filter and washed with 96 per cent alcohol. The precipitate is then washed into a beaker, dissolved by adding a slight excess of fifth-normal hydrochloric acid, and titrated with fifth-normal sodium hydrate, using for an indicator an alcoholic solution of carminic acid (*Acidum carminicum* Merck).—L. H. MERRILL.

The determination of nitrites, B. GRUTZNER (*Rev. Internat. Falsif., 11 (1898), No. 1, p. 21; abs. in Ztschr. Angew. Chem., 1898, No. 13, p. 307*).—From 0.1 to 0.2 gm. nitrite in 500 cc. of water is decomposed with 0.5 gm. potassium chlorate. A known volume (in excess) of tenth-normal silver solution acidified with nitric acid is added and the mixture vigorously shaken. After a few minutes the excess of silver is titrated with tenth-normal sodium chlorid solution.

Volumetric estimation of sodium, H. J. HORSTMAN-FENTON (*Jour. Chem. Soc. [London], 73 (1898), No. 424, pp. 167–174*).

Methods and solvents for estimating the elements of plant food probably available in soils, W. MAXWELL (*Jour. Amer. Chem. Soc., 20 (1898), No. 2, pp. 107–110*).—This is a brief preliminary note on investigations more fully reported elsewhere (see p. 128).

Simplification of Hopkins's method for the estimation of uric acid in urine, O. FOLIN (*Ztschr. Physiol. Chem., 24 (1897), No. 3, pp. 224–245*).—The author calls attention to the possibility of error in Hopkins's method, and seeks to correct it by the substitution of ammonium sulphate in place of ammonium chlorid as a reagent for the precipitation of the uric acid.—J. B. LINDSEY.

A new modification of Clerget's method, specially applicable to after products and molasses, A. R. LING and J. L. BAKER (*Jour. Soc. Chem. Ind., 17 (1898), No. 2, pp. 111–114*).

Note on the tests for distinguishing boiled from unboiled milk, A. LEFFMANN (*Analyst, 23 (1898), No. 265, p. 85*).—When a solution of diamidobenzin is added to unboiled milk, with a few drops of hydrogen dioxid, a deep blue color appears. This property is lost if the milk is heated to 180° F.

On the determination of the amount of butter contained in margarin, A. MÜNTZ and H. COUDON (*Ann. Sci. Agron., 1897, II, No. 2, pp. 281–294*).

The testing of margarin, butter, and cheese (*Ztschr. Angew. Chem., 1897, No. 24, pp. 790–792*).

Butter and fat analysis, A VON ASBOTH (*Rev. Internat. Falsif., 11 (1898), No. 1, p. 15; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. 325*).

The determination of butter and the preservation of milk samples for analysis, DELYE (*Rev. Internat. Falsif., 11 (1898), No. 1, p. 27; abs. in Ztschr. Angew. Chem., 1898, No. 14, p. 324*).

Analysis of butter, F. JEAN (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 239–249*).

Observations on the analyses of samples of butter fat and other fats, E. SPAETH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 6, pp. 377–384*).

Analysis of lard and detection of vegetable oils in lard and in mixtures of lard and suet, J. JEAN (*2. Congrès Internat. Chim. Appl., 1896, II, pp. 401–426*).

Contributions to fat analysis, W. FAHRION (*Ztschr. Angew. Chem., 1898, No. 12, pp. 267–273*).

On O. Polimanti's method of estimating fat, J. NERKING (*Arch. Physiol. [Pflüger], 71, No. 7–8, pp. 427–430*).—This is a controversial article.

Qualitative and quantitative determinations of peanut oil in olive oil and other oils used for food, J. BELLIER (*2. Congrès Internat. Chim. Appl., 1896, IV, pp. 311–319*).

New reactions for detecting cotton-seed oil in mixtures, G. MORPURGO (*Ztschr. Nahr. Untersuch. u. Hyg., 12 (1898), No. 7, p. 119*).—Tests proposed by Cavalli, and by Tortelli, and Ruggeri are described.

On the partial saponification of oils and fats, R. HENRIQUES (*Ztschr. Angew. Chem., 1898, No. 15, pp. 238–245, fig. 1*).

On the determination of carbon monoxid diluted with large quantities of air, A. GAUTIER (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 11, pp. 793–795*).

The action of certain reagents on carbon monoxid with a view to its determination in the air of towns, A. GAUTIER (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 12, pp. 871–875*).

Preliminary study of a method of determining small amounts of carbon monoxid in the air, A. GAUTIER (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 13, pp. 931–937*).

On the determination of small quantities of carbon monoxid in the air and in normal blood, L. DE SAINT-MARTIN (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 14, pp, 1036–1039*).

A colorimetric method of determining silicic acid in water, A. JOLLES and F. NEURATH (*Ztschr. Angew. Chem., 1898, No. 14, pp. 315, 316*).

Rare ash constituents of the residual liquor from sugar manufacture, E. O. VON LIPPMANN (*Ber. Deut. Chem. Gesell., 30 (1897), No. 19, pp. 3037–3039*).—The author records finding in appreciable quantities lithium, titanium, manganese, and strontium.—J. P. STREET.

Gasometric apparatus, O BLEIER (*Ber. Deut. Chem. Gesell., 31 (1898), No. 3, pp. 236–239, figs. 2*).

Reflux condensers, J. J. SUDBOROUGH and M. E. FEILMANN (*Jour. Soc. Chem. Ind., 16 (1897), No. 12, pp. 979, 980, figs. 3*).—Description of a condenser for use in boiling ethereal and alcoholic solutions.—J. P. STREET.

A new hydrostatic balance, B. W. GERLAND (*Jour. Soc. Chem. Ind., 17 (1898), No. 1, p. 13*).

A constant temperature device, H. P. CADY (*Jour. Phys. Chem., 2, No. 4, pp. 242–244, fig. 1*).—A constant temperature water bath.

BOTANY.

Root tubercles and their production by inoculation, D. H. Otis (*Industralist, 21 (1898), No. 6, pp. 363–378, pl. 1, figs. 2*).—The author makes a general statement relative to the presence and function of tubercles on the roots of leguminous crops, and reviews the earlier as well as more recent investigations relative to them. He also reports investigations on root tubercle development of soy beans.

Soy beans have been grown at the Kansas Station since 1890, but frequent examinations of the roots failed to reveal the presence of any tubercles on them. The author secured from the Massachusetts Station a quantity of soil in which soy beans had been grown and tubercle development previously noted. Two varieties, yellow and medium green soy beans, were grown and different methods of inoculation practiced. In some of the plats a small quantity of inoculated soil was placed in each hill at the time of planting. In others an extract of the soil was made and this used for inoculation. The methods of culture and details of growth are given, in which it appears that the rows inoculated at the time of planting attained on the whole a little greater height than those inoculated with the extract after planting; the difference, however, was slight. All the inoculated plants showed a fairly uniform distribution of tubercles as well as a greater diameter of the lower part of the stem than the plants not so treated. Analyses of the crop showed a slight increase in nitrogen, protein, and water content. The yellow soy beans inoculated with the extract gave the largest yield of both beans and fodder, while the medium green not treated yielded the greatest quantity of beans, and the plat inoculated with soil the most fodder.

The field experiments were repeated in pots and extended to include a number of varieties of soy beans, and all plants inoculated either with soil or extract showed well-defined tubercles on their roots. The author undertook experiments in the greenhouse to ascertain the time of tubercle appearance. The first visible tubercles appeared thirteen days after the beans were planted, or eight days after the plants were above the ground. The effect of sterilizing the soil was noted, the Kansas soil being already sterile and the Massachusetts soil having been heated to 200° C.

Experiments in which the plants were inoculated at the top, middle, and bottom of pots showed that the organism producing the tubercles is incapable of very great vertical distribution throughout the soil. In order to secure proper distribution, a mechanical mixing of the soil is necessary. Inoculation experiments, in which different amounts of infected soil were used, showed no particular difference, either in the development of the plants or the tubercles on the roots. The action of light on the micro-organism was found to be without any appreciable effect. The effect of different temperatures on the inoculating material was tested, in which soil was heated to ten different points, varying from

40 to 150° C. Somewhat similar experiments were made in heating the soil extract, and it was found that the tubercles develop best at the lower temperatures and seem to decrease as the temperature increases. In pot experiments, in which adzuki beans, cowpeas, Canada field peas, alfalfa, and red clover were planted and inoculated with Massachusetts soil, no tubercles appeared on the roots of the adzuki beans or the cowpeas; the alfalfa showed a few, while on the clover and Canada field peas they were very numerous. This seems to show that the form of the organism causing the tubercles on the different plants varies.

Microscopic studies were made of sections of the soy-bean tubercle, and investigations made on the extent of the distribution of the micro-organism of the soy bean tubercle in the United States. It was found to be indigenous in the States of Indiana, Louisiana, Massachusetts, North Carolina, Rhode Island, and Tennessee, and has been established by inoculation in Connecticut and Kansas, while no tubercles have been found on this plant when grown in California, Florida, Iowa, Michigan, or South Dakota. The other States reporting have either not grown soy beans or have made no examination of their roots.

Concerning Alinit (*Nature, 57 (1898), No. 1479, p. 418*).—A note is given of this new substance prepared by Frederick Bayer & Co. It is claimed that it will have a beneficial effect on the growth of cereals, as in the case of Nitragin for leguminous crops. Alinit is a creamy yellow powder containing 2.5 per cent of nitrogenous constituents. It is the result of four years' laboratory experiments with different forms of bacteria, and the discoverer, M. Caron, claims that the specific organism used is a pure culture of *Bacillus ellenbachensis alpha*. The bacillus, in the form of spores, is contained in the powder and belongs to the well-known aerobic bacteria designated as the hay bacilli, resembling very closely *B. mycoides* and *B. megatherium*. It is claimed that when used as a fertilizer for cereal crops by the rapid growth of the micro-organism in the soil the combined nitrogen is made more available for the plant and that some of the atmospheric nitrogen is also secured. Further experiments will be necessary to determine the value of this substance.

The ash of epiphytes, R. C. KEDZIE (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 71–76*).—In a previous paper entitled "The chemical tripod in floriculture" the author stated that all plants in order to live and grow must receive nitrogen, phosphorus, and potash. Soon after the publication of this paper his attention was called by correspondents to the question of the presence of these substances, especially potash and phosphorus, in epiphytic plants. Analyses of a number of plants were made, in which it was found that these epiphytes were not deficient in potash or phosphoric acid. The author believes that the plants secure their mineral constituents from the water, the winds, and the bark of trees. The statement is made that in ordinary culture many of the orchids, like the cattleyas, degenerate and die within a few years. The author thinks that this is due to the lack of mineral fertilizers and sug-

gests that possibly it could be avoided by giving the plants a weak solution of phosphate of potash. He quotes articles in which similar recommendations have been made elsewhere.

Report of the botanist, C. F. WHEELER (*Michigan Sta. Rpt. 1896, pp. 133–135*).—The author gives a brief summary of the work carried on during the year, the lines of investigation being seed testing, plant diseases, herbarium work, and weed studies. Among the new weeds are reported the bladder ketmia (*Hibiscus trionum*), winged pigweed (*Cycloloma platyphylla*), and tumbling mustard (*Sisymbrium altissimum*). Of these the latter two are liable to prove troublesome.

Report of the department of botany and forestry, W. J. BEAL (*Michigan State Bd. Agr. Rpt. 1896, pp. 501, 502*).—A tabular statement is given showing additions to the herbarium and museum during the past year.

Plant protection against animals (*I. mezzi di difesa delle piánte contro gli animali. Naples: Geremicca, 1897, pp. 43*).

The preparation and use in class of certain cryptogamic material, M. A. BARBER (*Kansas Univ. Quart., 7 (1898), No. 2, pp. 111–113*).

Elements of scientific botany, J. WIESNER (*Elemente der wissenschaftlichen Botanik. Vienna: Alfred Hölder, 1898, vol. 1, pp. VIII, + 372, figs. 159*).—This volume treats of the anatomy and physiology of plants.

What is Alinit? J. STOKLASA (*Ann. Agron., 24 (1898), No. 4, pp. 171–174*).—Taken in part from Chem. Ztg., 1898, No. 20, pp. 181, 182.

Investigations of the bacteria in Alinit, A. STUTZER and R. HARTLEB (*Centbl. Bakt. u. Par , 2. Abt., 4 (1898), Nos. 1, pp. 31–39; 2, pp. 73–77*).—Studies are reported on the morphology and physiology of *Bacillus ellenbachensis alpha*.

Alinit (*Deut. Landw. Presse., 25 (1898), No. 22, p. 243*).

On a new generic type of Schizomycetes, E. ROZE (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 11, pp. 858, 859*).

Pathological notes, M. MOLLIARD (*Rev. Gén. Bot., 10 (1898), No. 111, pp. 87–101, pl. 1, figs. 6*).—Notes are given on the proliferation of the flowers of *Bromus erectus* caused by *Ustilago bromivora*; on the action of *U. longissima* on the floral structures of *Glyceria aquatica*; on a parasitic dimorphism of *Pteris aquilina*; and on morphological changes in Symplocos due to *Exobasidium symploci*.

The behavior of the kinoplasm and nucleolus in the division of the pollen mother cells of Asclepias cornuti, W. C. STEVENS (*Kansas Univ. Quart., 7 (1898), No. 2, pp. 77–85, pl. 1*).

Chlorophyll and its derivatives, F. G. KOHL (*Bot. Centbl., 73 (1898), No. 12, pp. 417–426*).

Can isolated chlorophyll grains separate oxygen in the light? L. KNY (*Bot. Centbl., 73 (1898), No. 12, pp. 426–439*).

Observations of stomata by a new method, F. DARWIN (*Proc. Cambridge Phil. Soc., 9, No. 6, pp. 303–308; abs. in Bot. Centbl., 73 (1898), No. 12, pp. 452–454*).

Studies of extra-floral nectaries, V. A. POULSEN (*Vidensk. Meddel. Naturh. Forening. Kjobenhavn, 1897, pp. 356–371, pls. 3; abs. in Bot. Centbl., 73 (1898), No. 12, pp. 454, 455*).

Anatomy and physiology of plants arranged for secondary classes, A. DAGUILLON (*Anatomie et physiologie végétales, a l'usage des éléves secondaire classique. Paris, 1898, pp. 279, figs. 253*).

Morphology and biology of the unicellular algæ, K. BOHLIN (*Ofvers. K. Svenska Vetensk. Akad. Förhandl. (1897), No. 9, pp. 507–529, figs. 10*).—A preliminary contribution to the knowledge of the subject.

Contributions to the knowledge of nyctrotropic movements, L. JUST (*Jahrb. Wiss. Bot. [Pringsheim], 31 (1898), No. 3, pp, 345–390, figs. 2*).

The rôle of water in growth, C. B. DAVENPORT (*Proc. Boston Soc. Nat. Hist., 28 (1898), No. 3, pp. 73–84*).

The rôle of phosphoric acid in vegetation according to the recent publications of Stoklasa and Dubbers, L. GRANDEAU (*Jour. Agr. Prat., 62 (1898), I, No. 9, pp. 310–312*).

The transpiration of plants and its dependence on external conditions, O. EBERDT (*Die Transpiration der Pflanzen und ihre Abhandigigkeit von ausseren Bedingungen. Marburg: Elwert, 1898, pp. VI + 97, pls. 2, figs. 2*).

Investigations on plant transpiration, O. SPANJER (*Bot. Ztg., 56 (1898), No. 3–4, pp. 35–81, pl. 1*).

On the structure of the mycorrhizas, L. MANGIN (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 13, pp. 978–981*).

Movements of the sensitive plant grown in water, G. BONNIER (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 14, pp. 1001–1007*).

Action of electricity on plants, TOLOMEI (*Atti R. Acad. Lincei, 5. ser., 7 (1898), No. 6, pp. 177–183*).

The action of X-rays on the living plant cell, G. LOPRIORE (*Nuova Rassegna, 1897; abs. in Bot. Centbl., 73 (1898), No. 12, pp. 451, 452*).—The author is said to have subjected *Vallisneria spiralis* for half an hour to the action of X-rays. The protoplasmic streaming was hastened. Longer exposure checked it. The action was also noted on the pollen tubes of Genista and *Darlingtonia coronillæfolia.*

FERMENTATION—BACTERIOLOGY.

The unorganized ferments, or enzyms, concerned in the brewing and distilling industries, I. O'SULLIVAN (*Jour. Soc. Chem. Ind., 16 (1897), No. 12, pp. 977–979*).—The author describes the enzyms concerned in the preparation of malt and in the fermentation of brewers' wort. These are diastase of translocation, which does not erode starch granules or liquefy starch paste, but dissolves "soluble starch;" cytase, a cyto-hydrolyst, which dissolves cellular matter and is rendered inactive on heating (it is not present to any extent, therefore, in kiln-dried malt); and diastase of secretion, an amylo-hydrolyst, which liquefies and hydrolyses starch paste at all temperatures up to 80°. Analytically it is shown that they contain nitrogen and are not albuminoids. The difficulty of proving their purity without altering the properties upon which their designation depends forces the conclusion that we do not know with certainty the composition of these important products of life.—J. P. STREET.

Red yeasts, KATHERINE E. GOLDEN and C. E. FERRIS (*Bot. Gaz., 25 (1898), No. 1, pp. 39–46, pls. 2*).—The authors describe three red yeasts which were obtained from the air of the laboratory and are designated by the numbers 1, 2, and 3. The growth of the different organisms on different media is fully described, and they are compared with the two well-known species of red yeasts, *Saccharomyces rosaceus* and *S. glutinis.* Of the three forms studied not one proved to be a true Saccharomyces, although No. 2 in all probability will prove to be *S. glutinis.* No. 1 appears to be a form between Saccharomyces and Torula. It forms spore-like bodies under ordinary conditions for spore formation, but as they neither form the spore wall nor bud in germinat-

ing they are not to be considered true spores. The authors believe that this is an undescribed species. No. 3, which from its peculiar appearance is easily recognized, is thought to be a new species of Mycoderma.

Insects and yeasts, I. GIGLIOLI (*Nature, 56 (1897), No. 1459, pp. 575–577, figs. 3*).—This briefly notes the results of experiments performed at the Portici Laboratory for Agricultural Chemistry to bring out the relations of insects, ants, flies, etc., to the invasion of fruits by yeast. As the yeast plants pass unaffected through the intestine of the fly and even multiply greatly in it, flies are very important factors in the transmission of alcoholic ferments.

Fermentation of must, E. H. RAINFORD (*Queensland Agr. Jour., 2 (1898), No. 2, pp. 125–128*).

What do we know concerning the origin of the Saccharomycetes? A. KLOCKER and SCHIONNING (*Ann. Inst. Pasteur, 12 (1898), No. 2, pp. 156–159*).

On the physiology of gentianose; its decomposition by soluble ferments, E. BOURQUELOT (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 14, pp. 1045–1047*).

Industrial sterilization by heat and high pressure, E. W. KUHN (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 702–713, pls. 3*).

Contributions to our knowledge of the micro-organisms and sterilizing processes in canning industries. II, The souring of sweet corn, S. C. PRESCOTT and W. L. UNDERWOOD (*Tech. Quart., 11 (1898), No. 1, pp. 6–30, pls. 5*).—A former article of this series was published in Tech. Quart., 10 (1897), No. 1, pp. 183–199 (E. S. R., 9, p. 120).

On the nitric ferment of Stutzer and Hartleb, W. KRÜGER (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 5, pp. 184–188*).

Relation of bacteriology to agriculture, A. STUTZER (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 387–402, ill.*).—Translated from the German.

The influence of the culture medium on the growth of bacteria, M. DEELEMAN (*Arb. K. Gesundheitsamte, 13 (1896), No. 3, pp. 374–402*).

Concerning the presence of bacteria, especially of root tubercle bacteria, in living plant tissues, O. ZINSSER (*Jahrb. Wiss. Bot. [Pringsheim], 30 (1897), p. 423; abs. in Naturw. Rundschau, 13 (1898), No. 8, p. 101*).

Contributions to the knowledge of acetic bacteria, D. P. HOYER (*Bijdrage tot de kennis van azijnbacterien. Delft, 1897, pp. 122*).

An injecting syringe for bacteriological purposes, A. CANTINI (*Centbl. Bakt. u. Par., 1. Abt., 23 (1898), No. 5–6, pp. 217, 218, fig. 1*).—There is described and figured a small syringe consisting of a small graduated glass tube drawn out to a needle point at one end and connected at the other with a rubber bulb. The apparatus has the advantage of being readily and quickly constructed in the laboratory. The bulb can be attached to glass tubes of different sizes.

Apparatus to facilitate the processes of fixing and hardening material, W. C. STEVENS (*Kansas Univ. Quart., 7 (1898), No. 2, pp. 107–110, figs. 3*).

Contributions on fermentation, A. STAVENHAGEN (*Ber. Deut. Chem. Gesell., 30 (1897), No. 19, p. 2963*).

The ferments of wine diseases, J. LABORDE (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 17, pp. 1223–1226*).

On the causes of the incomplete fermentation observed by Simonsen in sugar solutions prepared from wood, B. TOLLENS (*Ztschr. Angew. Chem., 1898, No. 15, pp. 337, 338*).

On the use of selected yeasts, E. KAYSER (*2. Congrès Internat. Chim. Appl., 1896, I, pp. 499–502*).

Contribution to the study of the nuclei of yeasts, M. BOUIN (*Arch. Anat. Micros., 1 (1898), No. 4, pp. 435–457, pl. 1*).—The author gives nuclear studies of *Saccharomyces cerevisiæ, S. pastorianus, S. ellipsoideus, S. ludwigii, S. membranafaciens, S.*

subcutaneous tumefaciens, Mycoderma cerevisiæ, and *M. vini*, describing their nuclei and the changes which they undergo.

Yeast and alcoholic fermentation, J. R. GREEN (*Nature, 57 (1898), No. 1486, pp. 591–594*).—The author summarizes the present information relating to these subjects.

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 26 (1898), Nos. 1, pp. 1–43, charts 13; 2, pp. 45–89, charts 10; 3, pp. 91–137, charts 13*).—Besides the usual summaries No. 1 contains an article on The tornado of January 12 at Fort Smith, Arkansas, by J. J. O'Donnell; and notes by the editor on mountain storms, Dr. Waltemath's moon, thunderstorms in California, snow rollers, and bright meteors.

No. 2 contains a special article on The search light for weather signals, by E. B. Calvert; and notes by the editor on civil-service examinations, promotion for merit, an American meteorological society, the semaquir, peculiar mountain storms, lunar rainbow, waterspout, photographs of meteorological phenomena, Greenwich noon, and whirling alto-cumulus clouds.

No. 3 contains special articles on Cumulus clouds over a fire, by R. DeC. Ward; Thunderstorms in New Brunswick, by S. W. Kain; Upper clouds and weather changes, by G. W. Richards; Normal annual sunshine and snowfall, by A. J. Henry; and The moon and the aurora, by H. A. Hazen; and notes by the editor on chinooks *vs.* the Kuro Siro, sulphur rains, moonshine and frost, and rain in the Hawaiian Islands.

Arizona weather and climate, E. M. BOGGS and N. H. BARNES (*Arizona Sta. Bul. 27, pp. 16–65*).—This is a revised edition of Bulletin 20 of the station (E. S. R., 8, p. 753). The additional data given in this bulletin relates principally to temperature.

Meteorological observations at Michigan Agricultural Experiment Station, 1895, R. C. KEDZIE (*Michigan Sta. Rpt. 1896, pp. 443–469*).—Tabulated daily and monthly summaries are given of observations during 1895 on hours of sunshine, temperature, atmospheric pressure, precipitation, humidity, wind movement, etc.

The summary for the year is as follows: Maximum temperature, 100° F., July 6, 7; minimum, −24°, February 4, December 12; mean, 46.67°; humidity, 80.05 per cent; atmospheric pressure (reduced to 32° F.), 29.077 in.; cloudiness, 51.04 per cent; amount of rain or melted snow, 22.8 in.; snowfall, 49.14 in.; number of thunderstorms, 13.

The rainfall tables of the British Islands, 1866–1890 (*Met. Council [Great Britain], Offic. Doc. 114, pp. 283, maps 3. London: Eyre & Spottiswoode, 1897*).—Tables give summaries of observations during this period at 492 stations, distributed as follows: 287 in England and Wales, 151 in Scotland, and 54 in Ireland. The maps show the main watersheds and catchment basins of the principal rivers. These tables include data contained in similar tables published in 1883, which covered the period from 1866 to 1880, with the addition of the rainfall records from 1880 to 1890.

Future rainfall, A. B. M. (*Nature, 58 (1898), No. 1489, pp. 30, 31, chart 1*).—By charting the series obtained by "algebraic addition, step by step, of a series of plus and minus values," it is shown that there is a regular recurrence in Great Britain at intervals of about thirty-five years of cold and wet periods. This bears out the statement of Brückner that such periodicity occurs in various parts of the world.

Investigations on the relation of atmospheric precipitation to plants and soils, E. WOLLNY (*Forsch. Agr. Phys.* [*Wollny*], *20* (*1898*), *No. 3*, *pp. 346–360*).—This is a general discussion of the influence of an excess or deficiency of water, injurious effects of water on the mechanical properties of soils, the leaching of soils, the accumulation of soluble salts in the soil, and the influence of snow, hail, etc.

Forecasts of frosts, R. C. KEDZIE (*Michigan Sta. Spec. Bul. 5, pp. 10*).—A popular discussion of means of forecasting frosts and protecting plants from injury. Among the means of protection suggested are irrigation and smudges.

On a new form of constant volume air thermometer, which shows the total pressure directly, and may be graduated in degrees of temperature, J. R. E. MURRAY (*Proc. Roy. Soc. Edinburgh, 21* (*1895–1897*), *pp. 299–302, figs. 2*).

Exploration of the air by means of kites (*Cambridge, 189–, pts. 3, pp. 43–128, pls. 7; reprinted from Ann. Astron. Observ. Harvard College, 42* (*1897*), *I*).

Forestry-meteorological studies, E. HOPPE (*Centbl. Gesam. Forstw. Wien, 24* (*1898*), *No. 3, pp. 99–126*).

On measures for the amelioration of the climate, H. STEINMETZ (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 110–130, ill. and charts*).—Treats of the frost phenomenon, drainage systems, and the forest problem.

The influence of the movements of the moon on the oscillations of the atmosphere, P. GARRIGOU-LAGRANGE (*Compt. Rend. Acad. Sci. Paris, 126* (*1898*), *No. 16, pp. 1173–1176*).

Influence of diffused solar light on the growth of plants, J. WIESNER (*Compt. Rend. Acad. Sci. Paris, 126* (*1898*), *No. 18, pp. 1287–1289*).

Monthly reports of the River and Flood Service, W. L. MOORE and P. MORRILL (*U. S. Dept. Agr., Weather Bureau Docs. 153, pp. 18, chart 1; 156, pp. 14, chart 1; 158, pp. 19, chart 1*).—Résumés of observations on river stages and conditions of navigation during the months of January, February, and March, 1898.

Wrecks and casualties on the Great Lakes during 1895, 1896, and 1897, W. L. MOORE and N. B. CONGER (*U. S. Dept. Agr., Weather Bureau Doc. 159, pp. 23, charts 3*).—A chronological record.

WATER—SOILS.

The Beeville Station: Soils, climate, water supply, and irrigation equipment, J. H. CONNELL and S. A. MCHENRY (*Texas Sta. Bul. 43, pp. 929–958, pls. 4, figs. 11*).—This is the first report of the experiment station in this part of southern Texas provided for by State appropriation.

Soils.—The region presents a gently rolling surface, which is largely devoid of forest growth, except along the water courses. The open prairie is covered with mesquite grass.

"The surface of the soil is a dark brown sandy loam, which lies over a whitish marl, carrying a large percentage of lime. This dark surface soil in some cases shades into a chocolate red, or turns to a sandy white on some of the hillsides. In the valleys it is almost black, because of the large amount of decayed vegetable matter contained, and in such situations it is usually heavy and obstinate under the plow, and the surface soil is several feet in depth, while on the slopes and tops of hills it varies from 6 to 18 in. in depth."

The soils of this region are located on the Fayette beds, and for the purpose of investigation were divided into three main groups: (1) Vegetable soils, (2) orchard soils, and (3) field crop soils. Samples of these soils were taken at three different depths, 1 to 6 in., 24 to 30 in.,

and 48 to 54 in., and analyzed. The results of analysis are given in the following table:

Analyses of Beeville soils.

	Vegetable soil.			Orchard soil.			Field crop soil.		
	1–6 in.	24–30 in.	48–54 in.	1–6 in.	24–30 in.	48–54 in.	1–6 in.	24–30 in.	48–54 in.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Silica and sand	87.92	67.9	19.82	89.06	80.2	18.99	89.74	62.88	29.21
Organic matter	4.36	4.79	1.63	3.70	4.38	2.36	4.87	5.12	3.42
Water	1.55	2.55	.92	2.07	4.25	.62	2.50	3.30	1.05
Oxids of iron and alumina	4.57	7.08	2.86	3.65	10.13	2.95	.95	6.33	1.49
Calcium oxid	.76	10.21	43.19	.67	.72	39.93	.60	9.04	35.37
Magnesium oxid	.47	.63	.65	.41	.31	.94	.13	.51	.39
Sulphuric acid	.09	.10	.19	.05	.04	.24	.08	.10	.10
Potassium oxid	.32	.24	.11	Trace.	Trace.	.16	Trace.	Trace.	Trace.
Sodium oxid	.13	.16	.25	.75	.37	.21	.86	.69	.62
Carbon dioxid	.58	.67	29.56	....	....	32.8	1.14	12.05	28.40
Phosphoric acid	.04	.03	.04	.01	.13	.04	.06	.04	.01

The conditions which tend to cause a rapid destruction of the organic matter in these soils are discussed and the means of preventing this loss are explained, the use of velvet beans as a green manure being especially recommended. The presence of sulphur and gypsum in the geological formation from which the soils are derived probably partly explains the rapid destruction of the organic matter.

Climate and rainfall.—Data for rainfall, temperature, cloudiness, and direction of the wind for each month from January, 1896, to August, 1897, are tabulated, and a chart shows the average annual precipitation in different regions of Texas. The maximum temperature recorded (104°) occurred in July and August, 1897; the minimum temperature (19°) occurred in January, 1897.

Agricultural water supply.—After general remarks on soil water, absorptive power of soils, and effect of subsoiling, the underground water supply of this region is discussed. It is stated that the region is underlaid at a depth of from 50 to 150 ft. by "a coarse water-bearing sand that supplies an abundant flow of good water in dug or bored wells at all times. This water rises to within 30 ft. of the surface in some cases, and can be economically raised for irrigation purposes and is largely used for domestic consumption. Windmills are in general use, but thus far we have been unable to learn of the successful use of mills for irrigating crops of more than 1 or 2 acres in each case."

The flow of these wells is, however, decreased to a marked extent by long-continued drought, the lowest point probably being reached during the months of September and October.

"The well on the station grounds is dug to a depth of 57 ft., and a 4-inch hole bored from this point to a depth of 74 ft. The water usually stands 8 ft. deep in the dug portion of the well, or a distance of 49 ft. from the surface of the ground. While using a windmill for driving the pump, the water fell some 20 ft. in this well, and when pumping with a gasoline engine we exhausted the water to a point as far down as was reached by the deep-well cylinder, but on forty strokes per minute (in April, 1897), this pump, on a 15-inch stroke, was run to lift 1,000 gal. of water per hour for twelve hours, and in removing these 12,000 gal. the water in the well was lowered, but not exhausted.

"In September, 1897, a careful test was made of the available supply in this well. The pump was placed on a 24-inch stroke and was run at the rate of forty-four strokes per minute. At this rate the well supplied 24 gal. per minute delivered at the reservoir (equal to 1,440 gal. per hour), but this fast pumping partially exhausted the supply of water in the well, after which a flow of 13 gal. per minute was obtained. This, we concluded, was the normal force of the stream supplying the well after some months of drought and very low average rainfall throughout the section to the north and west supposed to supply this sheet water that flows at a depth of 75 to 90 ft. below Bee County. During the preceding spring season the supply had been materially stronger."

To the north of Beeville and along the coast flowing wells are obtained by tapping this water-bearing stratum.

Irrigation.—The need of irrigation in the region of Texas in which Beeville is situated and the duty of water are discussed and the pumping outfit at the station is described. This consists of "a windmill and gasoline engine, so arranged as to use either wind or explosive gas as power for driving the pump, and is situated in a depression, or 'draw.' The reservoir is located on the rise of the hill and is 560 ft. east of the well and pump station. The top of the reservoir is some 15 ft. above the ground level of well. Water must be pumped from its level to surface of well (49 to 70 ft.) plus the 'rise' from well to discharge pipe in reservoir (15 ft.). This provides for a total pump lift of 64 to 85 ft. When pump is used regularly and water is lowered in well the lift is probably about 80 ft."

At the beginning a 12-foot steel windmill was relied on entirely to pump the water required, but "in many cases the windmill failed to show sufficient strength to run the pump for days at a time. In such cases the experimental crops would suffer severely from droughts."

"An existing popular idea to the effect that windmills can be relied upon to lift irrigation water from depths of 75 to 100 ft. must be critically examined by those intending to use mills for this purpose. All semiarid sections are supposed to have frequent and strong winds, but for windmill irrigation purposes they must also be regular, or, just at the critical crop-growing period, a calm may occur and entirely ruin the prospects of the farmer or trucker, and so cause the loss of labor and capital invested for that season. The regularity with which the wind blows, the depth from which water must be pumped, and the size of the receiving reservoir are the factors that determine the success of windmill irrigation plants."

In the spring of 1897 a 4-horsepower gasoline engine with pumping apparatus was installed, and it has been used with very satisfactory results. With this plant the cost of raising 1,000 gal. of water 65 to 85 ft. through 560 ft. of 2½-inch pipe has been found to be 8.42 cts., or at the rate of $4.58 per acre (2 acre-inches).

The construction of reservoirs is discussed and directions are given for the construction of dams with concrete, masonry, and puddle cores and with surfaces of coal-tar mastic and concrete gravel.

Statements regarding methods of distributing and applying irrigation water are reprinted from the Yearbook for 1895 of this Department, and the influence of irrigation water on the increase and rise of alkali in soils is briefly discussed.

Investigations on the influence of the physical properties of soils on the growth of crops, E. WOLLNY (*Forsch. Agr. Phys.* [*Wollny*], *20* (*1898*), *No. 3*, *pp. 291-341*).—This is a detailed account of experiments during several years with a large variety of crops grown in boxes and pots. The special subjects investigated and reported on in this article are inclination and exposure of the surface of the soil, depth of the cultivated soil layer, fineness of the soil particles, color of the soil, and character of the soil.

With normal weather conditions and sufficient moisture the greatest yield was obtained on soils having a southerly exposure and the greater inclination (not over 30°). Plants also started growth earlier in the spring on the soils with the greater inclinations. In dry weather, however, the opposite results were obtained.

There did not appear to be any direct and uniform relation between the depth of the soil and the growth of the plants.

Within the limits experimented with (less than 0.25 to 2 mm.) the smaller the soil particles the greater the yield.

Plants germinated more quickly and uniformly and produced larger crops in dark-colored soils than in light-colored soils.

With approximately the same chemical composition the highest yields were obtained from humus soils; the lowest from sandy soils.

The experiments show in general that the influence of the physical properties of soils on their productive capacity is of the highest importance and that fertilizers exert a most marked influence upon the physical properties of soils.

Relative sensitiveness of plants to acidity in soils, W. MAXWELL (*Jour. Amer. Chem. Soc.*, *20* (*1898*), *No. 2*, *pp. 103-107*).—The methods followed in the study of this subject are thus described:

"Two tubs having a diameter of 24 in. and a depth of 20 in. and perforated bottoms, which were covered with linen cloth, were each filled with 120 lbs. of air-dried soil of moderate fertility, having a neutral behavior toward acid and alkaline tests. These tubs were placed in tin pans which were 6 in. deep, the perforated bottoms of the tubs being raised 4 in. above the bottoms of the tin pans. The tin pans were filled with water up to the level of the perforated bottoms, and the water was kept up to that level until the soil in the tubs had absorbed moisture to saturation, the water absorbed being 48.2 per cent on the water-free weight of the soil. To tub No. 1 enough citric acid was added to make the whole volume of water absorbed a one-tenth per cent solution. To tub No. 2 citric acid was added to make the absorbed water a one-fiftieth per cent solution. In each of the tubs 17 varieties of seeds were planted, these being planted in a circle and equal distances apart. The seeds germinated quickly, were up within four days, and had a healthy appearance. After the plants were up and 1 in. high the mode of applying the acid was changed. When the acid was applied in the water absorbed by capillarity from the tin pans it was not equally distributed through the mass of the soil, but was more or less fixed by the bases in the soil at the bottom of the tubs, and did not reach the plants. Therefore the acid was dissolved in water and applied around the plants at the surface. This was controlled by determining the loss of water from the tubs by evaporation and replacing the lost water, with the weight of citric acid dissolved in it necessary to bring up the whole volume of water in the tubs to one-tenth per cent and one-fiftieth per cent solutions, respectively. This was repeated every fourth day."

The plants experimented with were black and white mustard, beets, mangel-wurzels, rape, carrots, white lupines, common bean, Windsor bean, winter vetch, crimson clover, alfalfa, pearl millet, wheat, maize, oats, and barley. The results show that all the cruciferous plants and clovers succumbed at once to the acid. Although certain of the leguminous plants and Gramineæ made considerable growth, only pearl millet reached normal development. "Its growth was steady and quite normal as compared with a plat of millet growing in a field near by, which it actually exceeded in development."

Soil humus, E. F. LADD (*North Dakota Sta. Bul. 32, pp. 272–276*).—A brief explanation is given of "what is meant by the term soil humus and in what way its presence in the soil is beneficial," based in part upon results of the author's own investigations and in part on results obtained at other stations. "The average of fifty-four determinations gave 13.79 per cent of organic matter for North Dakota soils and 4.55 per cent of humus." In eight analyses of North Dakota soils 41 per cent of the phosphates was found in the humus, the proportion ranging from 10 to 91 per cent. From 46 to 80 per cent of the total nitrogen was found in the humus, the average proportion being 61 per cent.

The objects and methods of soil analysis, E. W. HILGARD (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 20–25*).—This is a plea for the complete analysis (at least for the determination of lime, magnesia, iron, and soluble silica in addition to nitrogen, phosphoric acid, and potash) of the strong acid solution of soils. It is claimed that analysis must not only show whether "nitrogen, phosphoric acid, or potash are deficient or abundant, but it must also show what, from the general character of the soil, is the form in which these substances should be applied, and in what manner." This information can be obtained only by the determination of other constituents besides nitrogen, phosphoric acid, and potash.

It is questioned whether the sulphuric-acid method proposed by Goss has any advantages over the nitric-acid method heretofore practiced. The use of dilute hydrochloric acid for determining available potash and phosphoric acid in soils, as proposed by Goss, is believed to be a promising method.

"The remarkable effect of calcium chlorid, however, causes me to suggest that the effect of neutralization would, in the case of HCl, be quite different from that of citric acid, so far as potash is concerned; for in many cases the amount of calcium chlorid formed by neutralization will greatly exceed in its effects that of the HCl itself, and it would therefore seem that as a general reagent for the determination of available potash the latter is unavailable for the great majority of soils."

Drinking waters, E. F. LADD (*North Dakota Sta. Bul. 32, pp. 267–270*).—The total solids and sodium chlorid in twenty samples of artesian water and complete mineral analyses of three of the samples are reported, with notes on the interpretation of results of water analyses.

The underground waters of the Arkansas Valley in eastern Colorado, G. K. GILBERT (*U. S. Geol. Survey Rpt. 17, pt. 2, pp. 551–601; abs. in Tech. Quart., 11 (1898), No. 1, Rev. Chem., p. 23*).

Preliminary report on artesian waters of a portion of the Dakotas, N. H. DARTON (*U. S. Geol. Survey Rpt. 17, pt. 2, pp. 603–695; abs. in Tech. Quart., 11 (1898), No. 1, Rev. Chem., pp. 23, 24*).

The water resources of Illinois, F. LEVERETT (*U. S. Geol. Survey Rpt. 17, pt. 2, pp. 695–828; abs. in Tech. Quart., 11 (1898), No. 1, Rev. Chem., p. 24*).

Temperatures of different soils, D. J. CROSBY (*Michigan Sta. Rpt. 1896, pp. 198–200*).—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 374).

Soil temperature observations at the observatory of Catania, 1892–1896, E. TRINGALI (*Atti Accad. Gioenia Sci. Nat.; abs. in Nature, 58 (1898), No. 1489, p. 40*).—"In addition to confirming the well-known laws according to which the diurnal and annual variations of temperature decrease and undergo retardation with increasing depth," the results of these observations "show that at Catania the velocity of transmission of the diurnal fluctuations is about 20 cm. for every 7½ hours, and that these fluctuations become practically unimportant at a depth of 60 cm., where they only amount to a few tenths of a degree when the atmospheric temperature changes as much as 17 degrees."

Researches on the composition of the soil of Crau and of the soils and clays of Durance, G. CASTIN (*Ann. Sci. Agron., 1898, I, Nos. 1, pp. 155–160; 2, pp. 161–239*).—Analyses of typical soils of this region with notes on their characteristics.

Examination of marsh soil samples, G. E. STANGELAND (*Tidsskr. Norske Landbr., 5 (1898), pp. 180–182*).

Forests and subterranean waters in level regions, E. HENRY (*Ann. Sci. Agron., 1898, I, No. 1, pp. 1–24*).

Iowa Geological Survey. VI, Report on lead, zinc, artesian wells, etc. (*Des Moines: Iowa Geological Survey, 1897*).—Contains, among others, papers on artesian wells and relation of Wisconsin and Kansas drifts in central Illinois.

FERTILIZERS.

The fertilizer industry, J. HYDE and G. K. HOLMES (*U. S. Dept. Agr., Division of Statistics Bul. 13, pp. 27*).—This bulletin contains statistics of production and consumption of fertilizers in the United States; a preliminary report on a statistical study of the relation between the fertilizers applied and the profit obtained in cotton growing; and notes on fertilizer inspection, with abstracts of the different State fertilizer laws and a list of fertilizer inspection officials.

It is estimated that the total number of establishments in the United States that manufacture fertilizers is about 700. In 1880 the census reported 364; in 1890, 390. "Since 1890 there has been a very considerable development in the manufacture of fertilizers, especially in South Carolina and Florida, where phosphate mining has assumed large proportions."

It is stated that attempts to collect statistics of the production of fertilizers have been unsuccessful. "With respect to consumption, however, the case is different, and it has been possible, with the aid of State fertilizer inspectors and other State officials, to ascertain approximately the quantity and value of the commercial fertilizers consumed in the United States in the calendar year 1896." More or less complete data are also given for the period from 1891–1895, and for the first nine months of 1897.

The data for 1896 and up to October 1, 1897, are given in the following table:

Commercial fertilizers consumed in the United States in 1896 and up to October 1, 1897.

State.	1896.		To October 1, 1897.	
	Amount.	Value.	Amount.	Value.
	Tons.		*Tons.*	
Vermont	13,000	$401,700	14,000	$408,660
Connecticut	20,000	600,000	....	....
New York	150,000	4,621,500	....	....
New Jersey	56,355	1,736,298	....	....
Pennsylvania	150,000	3,750,000	150,000	3,750,000
Virginia	171,704	4,034,944	....	....
North Carolina	187,429	2,811,435	203,097	3,046,455
South Carolina	199,497	2,792,958	240,000	3,120,000
Georgia	335,618	4,698,652	401,979	5,225,727
Florida	26,389	580,558	20,149	443,278
Alabama	100,000	1,400,000	96,154	1,250,000
Mississippi	32,270	575,234	42,550	752,238
Louisiana	10,051	165,842	12,542	206,943
Arkansas	....	....	1,000	20,000
Tennessee	19,445	486,125	25,883	647,075
West Virginia	28,433	574,665	25,335	532,164
Kentucky	19,550	488,750	18,500	462,500
Ohio	51,192	1,279,800	....	....
Michigan	3,500	[1] 87,500	....	....
Indiana	41,900	1,047,500	....	....
Wisconsin	200	6,000	....	....
Missouri	2,000	51,500	....	....
Utah	5,530	110,621	....	....
Total	1,624,063	32,301,582	....	....
Balance of United States [1]	270,854	5,387,287	....	....
Grand total	1,894,917	37,688,869	....	....

[1] Purchases for farm use as reported in census of 1890, at average value for 1896.

Statistics of production and consumption of fertilizers are republished from the Tenth and Eleventh Censuses and from reports of the U. S. Department of Labor and of the Geological Survey, and a statement of imports and exports of fertilizing materials is quoted from reports of the Bureau of Statistics of the U. S. Treasury Department.

Returns from 1,495 cotton planters, giving "the cost of fertilizers used in raising cotton in 1896 on an average acre under cotton cultivation" besides "other items of expense and the income received from the cotton and seed," are stated in tabular form, those who made a profit being separated from those who suffered a loss and each class tabulated according to the amount expended for fertilizers.

"It appears that there were 21 planters who spent less than $1 each per acre for fertilizers, and that their average profit was $4.62 per acre. The planters who spent from $1 to $1.99 per acre for fertilizers had an average profit of $5.09 per acre; those who spent from $2 to $2.99 had an average profit of $5.34; those who spent from $3 to $3.99 had an average profit of $5.91; those who spent from $4 to $4.99 had an average profit of $7.96; those who spent from $5 to $5.99 had an average profit of $8.76; while the planters whose fertilizers cost them per acre $6 and over, had an average net profit per acre of $12.51.

"It will thus be noticed that increase of expense for fertilizer in cotton raising apparently leads to increase of profit, and further, that, as far as this table discloses, the point of diminishing returns was not reached in the total for the five States that are included, and where it was reached, apparently, in any State, the result is probably a chance one due to the small number of returns."

Investigations on manure at Lauchstädt, 1896-1897, M. MAERCKER and W. SCHNEIDEWIND (*Landw. Jahrb., 27 (1898), No. 1-2, pp. 215-240, pls. 3*).—These include (1) studies of the loss of nitrogen from manure in deep stalls and in open and covered manure heaps, and (2) experiments with preservatives.

Three experiments with deep-stall manure are reported, two with manure from cattle and one with manure from sheep. The first experiment with cattle was made with 12 animals and lasted for 136 days (June 16 to October 29, 1896). In the second experiment 14 steers were used and the experiment lasted from November 6, 1896, to May 21, 1897 (197 days). The experiment with sheep was made with four lots of 15 animals each and lasted from June 20, 1896, to January 14, 1897. The stalls used in these experiments were 0.65 meter deep and had impervious cement bottoms.

Parallel with the experiments on deep-stall manure under cattle, studies were made of the losses of nitrogen from open and covered heaps of manure from animals fed the same kinds and amounts of food and supplied with the same amount of litter as in the deep-stall experiments. Samples of manure for analysis were taken daily. Not only the total nitrogen, but also the albuminoid, amid, ammoniacal, and nitric nitrogen were determined.

In the experiments with preservatives the manure from 9 cows during a period of 11 days was divided each day into four lots which were sampled for analysis and packed separately in pits. Lot 1 received no preservative; lot 2 received 30 per cent of marl containing 13 per cent of carbonate of lime; lot 3, 30 per cent of marl and 2 per cent of peat; lot 4, 6 per cent of sodium bisulphate, corresponding to 1.5 per cent of free sulphuric acid. The total albuminoid, amid, ammoniacal, and nitric nitrogen in the fresh manure and in the manure after remaining in the pits three months were determined.

The results of the experiments show that the loss of nitrogen in deep stalls was small when the manure was examined immediately after the animals were removed from the stalls, being in one case 13.2 per cent and in another 13.25 per cent of the total nitrogen. This was true whether the experiments were conducted in winter or in summer. The loss, however, increased to 34.8 per cent when the manure was allowed to remain four weeks during warm weather after the animals had been removed from the stalls. If the manure, therefore, can not be carried to the field immediately after the removal of the animals it should be covered with soil or treated with a preservative.

In an ordinary uncovered manure heap the loss of nitrogen was 37.4 per cent. In a covered heap it was very little less, being 36.9 per cent. This slight difference in the loss in the two cases is thought to have been due to the fact that the weather conditions were especially favorable to the preservation of manure in the uncovered heap, being wet and cloudy, while the manure in the covered heap was allowed to

become too dry. That decomposition was more rapid in the covered heap than in the uncovered heap is shown by the fact that the loss of organic matter was 30 per cent in the former and only 22 per cent in the latter. This shows the importance, especially in case of covered manure heaps, of keeping the manure moist and well compacted.

In case of the covered and uncovered heaps the liquid manure was allowed to drain off and was collected in separate receptacles. Under these conditions there was almost a total loss of the nitrogen in the liquid, the amount falling from 0.2–0.3 per cent to 0.01–0.05 per cent.

It appears that during the decomposition which goes on in the manure heap considerable amounts of nitrogen in the simpler forms are converted into albuminoid and similar complex compounds, this change being greater in case of deep-stall manure than in that from ordinary stalls. By adding an excess of 0.5 per cent of sulphuric acid to the manure which had remained in the deep stalls 136 days the amount of albuminoid nitrogen was reduced from 65.1 per cent to 47.5 per cent of the total nitrogen, ammoniacal and amid nitrogen being correspondingly increased.

The addition of 30 per cent of marl to the manure reduced the loss of nitrogen from 22.6 to 9.9 per cent, and the addition of 30 per cent of marl and 2 per cent of peat reduced the loss to 6.1 per cent. The best results, however, were obtained by adding 6 per cent of sodium bisulphate, corresponding to 1.5 per cent of sulphuric acid, which reduced the loss to 1.3 per cent. The manure treated with sodium bisulphate remained practically unchanged.

On the losses of ammonia which take place in the preparation of barnyard manure, P. P. DEHÉRAIN (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 19, pp. 1305–1310*).—This is a brief account of laboratory experiments with ammonium carbonate, urine, and urine and straw, undertaken for the purpose of explaining the losses of nitrogen from manure. A solution of ammonium carbonate lost 73 per cent of its nitrogen in 30 days in the open air. In a closed flask in which was suspended a dilute solution of sulphuric acid to absorb ammonia 12.1 per cent of the nitrogen passed off from a solution of ammonium carbonate in 3 days and 24.2 per cent in 8 days. In closed flasks provided with sulphuric acid to absorb ammonia and sodium hydrate to absorb carbon dioxid 39.3 per cent of the nitrogen escaped in 3 days and 83 per cent in 8 days. In an atmosphere charged with carbon dioxid the escape of ammonia was very slight. Urine exposed to the air lost 45 per cent of its nitrogen in one month. In a closed flask the loss in the same time was only from 5.6 to 6.6 per cent. In flasks provided with sulphuric acid for absorbing the ammonia 21 per cent of the nitrogen of the urine escaped in 5 days, but at the end of that time none of the ammonia formed had been absorbed by the sulphuric acid. At the end of 11 days, however, 19 per cent of the nitrogen of the urine was found in the sulphuric acid. When provision was made for absorption of

both ammonia and carbon dioxid in a closed flask there was a loss of only 2.9 per cent of nitrogen in 5 days, but 52 per cent in 11 days. In experiments in which 4 parts of urine were mixed with 1 part of straw (an insufficient amount to absorb all the urine) and exposed to the air during the summer (June, 1897), 58.3 per cent of the nitrogen escaped in 2 days, 70 per cent in 4 days, 72.6 per cent in 6 days, and 75.7 per cent in 8 days. These figures serve to indicate the great losses which may occur when insufficient amounts of litter are used.

In experiments in which litter was used in larger quantities, 1 part of litter to 2 of urine, the losses of nitrogen in the open air were only 7.2 per cent in 8 days. In closed flasks in which arrangements were made for the absorption of the ammonia and carbon dioxid 7.9 per cent of the nitrogen escaped in 3 days, 31.5 per cent in 6 days, 52.6 per cent in 8 days, and 59.7 per cent in 12 days. In an atmosphere of carbon dioxid no nitrogen escaped from the mixture, although the larger part of the nitrogen present was converted into ammonia. This is the condition in a well-constructed and compacted manure heap.

Potash: Its commercial and agricultural relations and a chemical method for its accurate estimation in soil, A. T. NEALE, W. H. BISHOP and C. L. PENNY (*Delaware Sta. Bul. 36, pp. 24, figs. 3*).—The economy of using potash fertilizers is discussed and it is shown that in spite of "a decline in values of all farm products and in spite of a decline of 65 per cent in the phosphate market the muriate of potash has been held for fifteen years unchanged in quality and in price." In view of this fact it is recommended that those systems of farming be practiced which utilize the latent potash of the soil. For this purpose the old-fashioned combination of lime and clover is considered especially valuable. It is suggested that from 7½ to 10 bu. of stone lime per acre applied with an ordinary grain drill with fertilizer attachment will be found as effective in many cases as the heavier applications which have been hitherto applied.

The results of an experiment with different fertilizer mixtures during 1894–1897 on sweet corn, crimson clover, cowpeas, oats, and red clover are reported. Muriate of potash gave noticeably good results on sweet corn and red clover, and the mixture of muriate of potash and acid phosphate was especially effective on cowpeas.

Potash was determined in the first and second foot of the soil of these plats by the following method: Samples of soil were ignited to dull redness and pulverized until they would pass a sieve of 80 meshes to the inch. Five hundred grams of this pulverized soil was placed in a 2-liter Jena glass flask with 1 liter of 20.7 per cent hydrochloric acid, and heated by means of steam to 100° in a rotary apparatus for 7 hours. The apparatus used for this purpose is described and figured. The acid solution obtained was filtered without washing, and a portion of the filtrate was taken for further operation. The amount so used was found by calculations based on the chlorin content of the acid solution. The method of calculation is fully explained.

The acid solution taken for analysis was evaporated to dryness in a liter Jena flask, using an air blast to hasten evaporation. The special apparatus used for this purpose is described and illustrated. The dried residue was taken up with water and boiled until all the normal salts were dissolved and the basic precipitate was in the form of a fine powder. All the bases present which formed insoluble carbonates or hydroxids were precipitated by adding freshly prepared silver carbonate until all chlorin was precipitated.

A second partition similar to the one just described was effected at this point by weighing the solution with the insoluble precipitate and, after drying the latter at a gentle heat, deducting its weight. The filtrate from this precipitate contains potash and soda, a trace of magnesia, some lime as bicarbonate, a little manganese, and some silver carbonate, and is alkaline in reaction. It was evaporated to dryness, which separated the silver, manganese, and lime. The filtrate from this residue was acidified with hydrochloric acid, and the potash determined in the usual way. In all cases evaporation was hastened by the use of the air blast.

The method "is designed for investigations important enough to justify the expense. The cost of so slow and tedious processes would be prohibitive for transient commercial purposes."

The results of the determinations of potash in the soils of the different plats showed no variations which could be traced to the different systems of fertilizing employed.

Inoculation of soil with ferments, P. P. DEHÉRAIN (*Ann. Agron., 24 (1898), No. 4, pp. 174–180*).—This is a general discussion of the subject under the following heads: The introduction of ferments into the soil—Nitragin, alinite, and nitrifying soils; organisms which naturally occur in the soil, and influence of medium on the activity of organisms. The necessity for investigating the conditions under which it proves profitable to inoculate soils with organisms which fix nitrogen is pointed out. It is suggested that the contradictory results obtained by different investigators may be due to insufficient knowledge as to the medium which is best suited to the growth of the different organisms.

The conservation of barnyard manure viewed from a practical standpoint, A. ARNSTADT (*Fühling's Landw. Ztg., 47 (1898), No. 2, p. 66*).

The fertilization of the Campine, L. BAREEL (*Rev. Gén. Agron., 1898, Nos. 2, pp. 73–77; 4, pp. 173–177*) —Green manuring, the use of night soil, and sewage irrigation are discussed, especial attention being given to the last.

Investigation on the action of sulphate of ammonia and nitrate of soda, G. KLOEPFER (*Untersuchungen über die Wirkung des schwefelsäuren Ammoniaks und des Chilisalpeters. Essen: G. D. Baedecker, 1898*).

Comparative experiments with ammoniacal and nitric nitrogen (*Deut. Landw. Presse, 25 (1898), Nos. 25, pp. 271, 272, figs. 2; 26, pp. 284, 285, figs. 4*).—This is a summary of the experiments by Kloepfer, which indicated that sulphate of ammonia is more economical than nitrate of soda, especially for application to cereals in the spring.

Ammonium salts vs. nitrate of soda, P. WAGNER (*Deut. Landw. Presse, 25 (1898), Nos. 30, p. 327, fig. 1; 31, pp. 336, 337*).—Experimental data are quoted to show that the conclusions of Kloepfer (see above) regarding the greater economy as a fertilizer of ammonium salts over nitrate of soda are erroneous.

Nitrate of soda crisis in Chile and the guano trade in Peru (*Fühling's Landw. Ztg., 47 (1898), No. 5, p. 195*).

Apparatus for grinding superphosphate (*Ztschr. Angew. Chem., 1898, No. 13, pp. 303, 304, fig. 1*).

Difference in action of muriate of potash and sulphate of potash (*L'Engrais, 13 (1898), No. 13, pp. 300–302*).—A popular summary of investigations on this subject.

The use of potash salts, MAIZIÈRES (*L'Engrais, 13 (1898), No. 17, pp. 395–397*).—Statistics of the production and distribution of the various Stassfurt salts, by countries, 1893–1897.

The use of salts of potash in agriculture (*L'Engrais, 13 (1898), No. 18, pp. 420, 421*).

Analyses of licensed commercial fertilizers, F. W. WOLL (*Wisconsin Sta. Bul. 66, pp. 7*).—Analyses of five samples of fertilizing materials are reported, accompanied by notes on the terms used in stating analyses and on valuation of fertilizers.

Composition of commercial fertilizers, H. B. MCDONNELL ET AL. (*Maryland Sta. Bul. 52, pp. 49–105, fig. 1*).—Tabulated analyses and valuations of 393 samples of fertilizing materials examined during the period from August, 1897, to January, 1898; a list of fertilizers licensed for sale in Maryland for the year ending February 1, 1898; and the text of the State fertilizer law.

Commercial fertilizers, H. A. HUSTON and W. J. JONES, Jr. (*Purdue University Spec. Bul. May, 1898, pp. 8*).—General statements regarding the amount and character of fertilizers sold in Indiana during the past season, notes on valuations, and tabulated analyses and valuations of 340 samples of fertilizing materials.

Commercial fertilizers, B. H. HITE (*West Virginia Sta. Bul. 51, pp. 51–85*).—This bulletin includes tabulated analyses and valuations of 184 samples of fertilizers examined during 1897, accompanied by notes on the nature and source of various materials supplying phosphoric acid, potash, and nitrogen; and on humus, stimulant fertilizers, home-mixing of fertilizers, valuation, and inspection of fertilizers. The text of the State fertilizer law is given.

Analyses of commercial fertilizers, B. W. KILGORE (*Mississippi Sta. Bul. 48, pp. 7*).—Analyses and valuations of 39 samples of fertilizing materials are reported.

Fertilizers, J. H. STEWART and B. H. HITE (*West Virginia Sta. Spec. Bul. May 1, 1898, p. 1*).—Tabulated analyses and valuations of 144 samples of fertilizers registered in West Virginia during the period from January 1 to May 1, 1898.

Inspection of commercial fertilizers, R. C. KEDZIE (*Michigan Sta. Rpt. 1896, pp. 209–222*).—A reprint of Bulletin 126 of the station (E. S. R., 7, p. 380).

Manuring experiments, 1897 (*Jour. Agr. and Ind. South Australia, 1 (1898), No. 9, pp. 680–687*).—A report on cooperative fertilizer experiments.

Fertilizer experiments conducted at Mustiala experiment station (Finland) during 1894, A. RINDELL (*Landtbr. Styr. Meddel., 1897, No. 20, pp. 1–30*).—Includes field trials with fertilizers for oats, examination and analyses of marsh soils, pot experiments with different phosphates, and culture trials with potatoes.

FIELD CROPS.

Some experiments in corn raising, C. D. SMITH (*Michigan Sta. Bul. 154, pp. 259–288, dgms. 2*).—This bulletin gives a report of the work with the selection of seed, thickness of planting, and cultivation of corn, and on the study of the relative value of the leaves, stalks, and ears; the loss in the silo of corn cut at different stages of growth; and the stage of growth when the crop contains the largest amount of nutriment. The results are discussed and given in tables.

In 1897 two plats were planted to corn; one with seed grown in 1895,

the other with seed grown in 1896. In 1895 the corn had ripened well; in 1896 the crop was not fully as mature. The seed of 1895 produced a total yield of 19,134 lbs. per acre and the seed of 1896, 17,210 lbs. The dry matter produced per acre was 7,749 lbs. and 6,970 lbs., respectively. The difference in favor of seed of 1895 was over 11 per cent.

In 1896 five plats and in 1897 four plats were planted to corn, the thickness of planting being different for each plat. The season of 1896 was wet, while of 1897 the summer was dry. The distance of planting and the results for the two seasons are given in the following table:

Yields per acre of fodder corn on thickly sown and thinly planted plats, 1896–97.

No. of plat.	Distance of planting.	Green fodder.	Dry matter.	Protein.	Nitrogen-free extract.	Crude fiber.	Fat.
	1896.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1	Seed drilled in rows 7 in. apart	30,608	9,411.96	300.24	6,056.59	2,459.35	164.71
2	Rows 14 in., kernels 3 in. apart	17,008	5,483.38	188.08	3,651.93	1,295.72	110.76
3	Rows 2 ft. 4 in., krnl. 3 in. apart	21,860	7,500.17	588.01	5,016.11	1,359.03	269.26
4	Rows 3 ft. 9 in., hills 1 ft. 10 in., 4 kernels to a hill	19,344	5,814.81	389.01	3,785.44	1,208.90	185.49
5	Hills 3½ ft. by 3½ ft., 4 kernels to a hill.	16,416	4,790.19	331.96	3,115.06	922.11	170.05
	1897.						
1	Rows 7 in., kernels 3 in. apart	16,870	5,940.00	237.87	3,965.97	1,347.00	96.67
2	Rows 14 in., kernels 3 in. apart	19,724	7,454.00	394.48	4,871.83	1,600.40	156.01
3	Rows 28 in., kernels 3 in. apart	16,100	6,295.00	....	....	....	....
4	Rows 42 in., kernels 3 in. apart	17,210	6,970.00	526.80	4,885.23	1,085.78	120.00

The results obtained at other stations are considered and the composition of the dry matter of the crops is given. For silage corn 3½ ft. between rows and from 3 to 6 in. between plants in the rows are considered favorable distances.

Cultivation tests were made on three plats. The corn was planted May 8 and was harrowed and given two cultivations prior to June 25, when the test was begun. Plat 1 was left without cultivation; plat 2 was cultivated twice per week up to July 21, and again August 6; and plat 3 was cultivated twice after June 25. On July 22 the weeds were cut from all the plats. From June 25 to the end of August 30 soil samples were taken for determining the water content, the average being given in the following table:

Water content of three corn plats.

	Plat 1, uncultivated.		Plat 2, cultivated twice a week.		Plat 3, ordinary cultivation.	
	Per cent.	Amount per cubic foot.	Per cent.	Amount per cubic foot.	Per cent.	Amount per cubic foot.
		Pounds.		*Pounds.*		*Pounds.*
First foot	12.70	11.18	14.91	13.12	14.79	13.02
Second foot	12.55	12.30	12.99	12.73	12.22	11.97
Third foot	14.51	14.22	14.86	14.56	15.18	14.87

The relative development of ears, stalks, and leaves was studied in 1896 and 1897. The composition of these different parts of the plant at

different dates is given in tables. The results in the following table were obtained in 1897:

Total weight and weight of dry matter of leaves, stalks, and ears of 200 stalks of dent corn.

	Total weight.				Dry matter.			
	Leaves.	Stalks.	Ears.	Total.	Leaves.	Stalks.	Ears.	Total.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
August 10	184.0	187.50	22.50	394.00	34.48	31.74	1.69	67.91
August 25	197.0	207.50	110.50	515.00	52.36	48.91	26.20	127.47
September 6	181.0	191.75	150.00	522.75	53.65	44.85	56.37	154.87
September 15	128.5	163.50	154.75	446.75	42.77	38.13	71.56	152.46

From investigations to ascertain when corn contains the largest amount of nutriment the results in the following table were obtained:

Yields per acre of green fodder, dry matter, and nutrients.

Date.	Stage of growth.	Green fodder.	Dry matter.	Protein.	Nitrogen-free extract.	Fat.	Fiber.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
August 10	Tasseled	21,203	3,670.24	472.73	1,828.15	67.90	1,010.05
August 25	Roasting	25,493	5,320.39	576.08	3,212.45	143.11	1,148.67
September 6	Glazing	25,865	7,110.29	711.03	4,554.14	199.08	1,294.78
September 15	Ripe	23,007	8,020.24	696.96	5,356.72	242.61	1,413.17

The results show that "to secure the greatest yields per acre of valuable nutrients the corn should not be harvested until fully glazed and until the early ears are well ripened."

An experiment was made to ascertain the losses in the silo with corn cut at different stages of growth. The results are tabulated below:

Losses of original substance and dry matter in the silo.

Date.	Corn put in.	Taken out.	Loss.	Loss.	Dry matter put in.	Dry matter taken out.	Loss.	Loss.
	Lbs.	*Lbs.*	*Lbs.*	*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*
August 10	2,709	2,508	201	7.42	468.93	374.70	94.23	20.08
August 25	3,246	2,939	307	9.45	676.79	508.74	168.05	24.81
September 6	3,297	3,100	197	6.00	906.35	706.80	199.55	22.01
September 15	2,934	2,626	308	10.40	1,022.79	748.67	274.12	26.80

In a discussion of the best time for cutting corn, the author quotes the results from a number of other stations.

Fertilizer, culture, and variety experiments on corn, R. J. REDDING (*Georgia Sta. Bul. 37, pp. 35–63*).—The work comprised variety tests, fertilizer tests, distance experiments, and a comparison of subsoiled and unsubsoiled plats. The results are reported in tabular form. Meteorological data for 1897 are given. Similar work has been formerly reported in Bulletin 30 of the station (E. S. R., 7, p. 943).

Fifteen varieties of corn were tested this season. The author considers further testing necessary before commenting on the results.

Shaw Improved and Higgin Improved are the only varieties tested for six years in succession and are considered as being uniform and persistent in yield.

A general fertilizer test proved unsatisfactory. It is stated that previous tests have indicated that, in a commercial fertilizer for corn on an average soil of middle Georgia, available phosphoric acid, potash, and nitrogen should be in the relative proportion to each other of 7 : 1.3 : 3.4, which would be secured in a mixture of 1,000 lbs. acid phosphate, 50 lbs. muriate of potash, or 200 lbs. of kainit, and 1,000 lbs. of cotton-seed meal.

The results of the distance experiments confirm the general conclusions drawn from previous experiments that "the more nearly the area of soil appropriated to each individual plant approaches the form of a square the greater will be the yield." Spacing the plants at different distances in rows of uniform width resulted in better yields from corn planted 4 by 3, with one plant in the hill, than when planted 4 by 2 or 4 by 4.

An experiment with subsoiled and unsubsoiled land for corn indicated that "subsoiling of the land covered by the experiment was not profitable." Subsoiling produced no appreciable effect.

Abstracts from former bulletins and the condensed reports on variety tests of cotton, the results of which are soon to appear in bulletin form, are given.

Fertilizer, culture, and variety experiments on cotton, R. J. Redding (*Georgia Sta. Bul. 39, pp. 107–135, pl. 1*).—These experiments are a continuation of work formerly reported in Bulletin 35 of the station (E. S. R., 9, p. 127). The results of the experiments and the meteorological data for the season are given in tables. Fertilizer formulas for various crops, with directions for mixing and applying them, are appended.

Among 21 varieties of upland cotton, Nancy Hanks, Texas Bur, Jackson "Limbless," and Culpepper Improved ranked highest in the value of lint and seed, in the order mentioned. Nancy Hanks, yielding 1,473 lbs. of seed cotton per acre, stood first in the yield of seed and lint, matured earlier and proved most profitable. Strickland Improved produced the largest bolls and Texas Oak and Jackson "Limbless" yielded the largest percentage of lint (37.1 per cent). King Improved, a small bolled, small seeded, early variety, and Strickland Improved, a large bolled, large seeded, late variety, yielded on an average of 7 plats each, 1,134 lbs. and 1,349 lbs. of seed cotton per acre respectively. A number of varieties, including Jackson "Limbless," are described in detail, and the address of the dealers in different varieties of cotton seed are given.

Distance experiments have been made for seven consecutive years. Plants were placed 1, 2, 3, and 4 ft. apart in rows 4 ft. apart. This year the best yield was obtained with a distance of 3 ft. between plants,

while on an average for seven years a distance of 1 ft. has given the best results. "In five of the seven years the most productive plats were those planted 4 by 1 and 4 by 2." Subsoiling in connection with these experiments proved ineffective. An experiment carried on for four years to ascertain the relation between the width of the rows and the distance between the plants when allowing 6 sq. ft. for each plant led to the conclusion from the average results for the period that the distance between rows should be little if any greater than the spaces between the plants in the row. The distances between the rows were 3, 4, 5, and 6 ft. and those between plants in the row 12, 14.4, 18, and 24 in. The average results show a regular increase in yield from the 6 ft. by 2 in. plats to the 3 ft. by 24 in plats.

Four different fertilizer tests were made. As between applying all the fertilizer before planting or applying part of it before planting and part of it at planting time, the results indicated no advantage in dividing the fertilizer. A comparison of raw bone meal and acid phosphate showed that raw bone meal was not a profitable source of phosphoric acid. A general fertilizer test was made on 17 plats. The normal application consisted of 468 lbs. acid phosphate, 32 lbs. muriate of potash, 208 lbs. of cotton-seed meal, and 32 lbs. nitrate of soda per acre. On some of the plats the various constituents were increased 50 per cent, but the amount of nitrate of soda remained constant in all cases. On plats which had received 50 per cent more of each of the three ingredients at an increased cost of $2.63 per acre the increase in the yield of seed cotton per acre over the plats which had received the normal application was only 23 lbs. The results show that the application of 468 lbs. of acid phosphate, 36 lbs. muriate of potash, and 286 lbs. of cotton-seed meal gave better financial results than any other proportions used in these experiments. Drilling and bedding on the fertilizers gave slightly better results than applying them broadcast.

The effect of various potash salts on the composition and yield of potatoes, T. PFEIFFER, E. FRANKE, O. LEMMERMANN, and H. SCHILLBACH (*Landw. Vers. Stat., 49 (1897), No. 4–5, pp. 349–385*).—A series of experiments were conducted to ascertain the effect of equal amounts of potash in various forms. The experiments made in 1894 led to no conclusions. In 1895 the work was continued in thirty-six pot and twelve plat experiments. Each pot contained 27 kg. of poor, sandy soil. The plats were a square meter in size, each surrounded by a solid wall and containing an equal amount by weight of soil bedded on a layer of gravel. In each set of experiments a fixed quantity of fertilizing material containing no potash was applied. In addition, 1 or 2 gm. of potash in the different forms mentioned below was applied to each pot and 15 gm. to each plat. The application of magnesium chlorid in connection with sulphate of potash and the application of kainit supplied equal amounts of chlorin. In 1896 the investigation was continued on the plats to ascertain the effects of the crude potash salts on the succeeding crop.

In the following table are the average results obtained from several pots in the pot experiments and from two plats in the plat experiments:

Yield of tubers and starch in 1895 and 1896 and a comparison of their production with and without potash.

Kind of potash fertilizer.	Potash applied per pot.	Yield per pot and per plat, 1895. Pot experiments. Tubers.	Yield per pot and per plat, 1895. Pot experiments. Starch.	Yield per pot and per plat, 1895. Plat experiments. Tubers.	Yield per pot and per plat, 1895. Plat experiments. Starch.	Increase (+) and decrease (—) of tubers and starch, calculated per acre, compared with yields obtained without potash, 1895. Pot experiments. Tubers.	Increase/decrease 1895. Pot experiments. Starch.	Increase/decrease 1895. Plat experiments. Tubers.	Increase/decrease 1895. Plat experiments. Starch.	Yield from plats, 1896. Tubers.	Yield from plats, 1896. Starch.
	Gm.	Gm.	Gm.	Gm.	Gm.	Lbs.	Lbs.	Lbs.	Lbs.	Gm.	Gm.
No potash....	......	301.3	40.55	3,970.5	674.7	....	....	....	....	1,660.3	324.8
Pure potassium chlorid .	1	331.7	52.16	4,650.8	767.3	+3,358	+1,283	+6,066	+ 819	1,611.0	302.2
	2	322.2	47.69			+2,316	+ 793				
Pure potassium sulphate	1	330.0	49.27	4,711.8	773.2	+3,171	+ 962	+6,609	+ 873	1,705.8	323.5
	2	341.2	48.71			+4,409	+ 900				
Pure potassium sulphate and magnesium chlorid (34.05 per cent chlorin)	1	325.0	46.08	3,083.7	486.3	+2,619	+ 615	—7,891	—1,683	1,654.2	285.7
	2	255.2	35.22			—5,095	— 588				
Kainit (33.45 per cent chlorin)	1	317.6	50.18	3,919.0	641.6	+1,800	+1,069	— 454	— 294	1,739.0	333.1
	2	292.0	39.30			—1,024	— 134				
Hartsalz (38.45 per cent chlorin)	1	226.5	(?)33.93	4,058.5	633.5	(—8,266?)	(—730?)	+ 784	— 374	1,533.5	290.1
	2	278.2	40.17			—2,547	— 45				

The amount of potash, lime, magnesia, chlorin, and sulphuric acid in the tubers and in the stems and leaves, and the amount of starch in the tubers is given in tables.

The following table gives the average mineral constituents of the fresh tubers for both seasons:

Average mineral constituents of fresh potatoes.

	Potassium oxid.	Calcium oxid.	Magnesium oxid.	Chlorin.	Sulphuric acid.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1895	0.506	0.016	0.039	0.067	0.095
1896	.524	.013	.038	.022	.084

It is suggested that the low yields in 1896 and the small chlorin content for the same year, which showed itself in the stems and leaves, may possibly be connected, but that from a single experiment no such conclusion could be safely drawn. From the results obtained the authors draw the following conclusions:

Potassium chlorid applied immediately before planting potatoes in quantities furnishing up to 250 kg. of potash per hectare (about 220 lbs. per acre) is as beneficial as an application of the sulphate supplying the same amount of potash. Under these conditions the chlorin contained in the chlorid is not detrimental to the growth of the plants.

The same amount of potash in the form of crude salts applied in the spring is of no benefit, and may even diminish the yield of starch. This is caused, on the one hand, by the high chlorin content of the crude salts, and, on the other, by the presence of magnesium compounds, especially magnesium chlorid. An insufficient amount of chlorin in the soil may influence the growth of the potato plant in such manner that the application of chlorids may be of direct benefit. Large yields of starch have been obtained even with a high chlorin content in the entire potato plant. It seems possible, therefore, that new varieties of potatoes may be bred, which are able to use larger amounts of chlorin, or may even be in need of larger amounts to produce a maximum yield. Strictly speaking, the results apply only to the variety ("Prof. Maercker") which was grown in this experiment.

Experiments with wheat, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 71, pp. 163-174*).—The series of experiments reported consisted of growing wheat continuously without manure, growing it in rotation, comparing subsoiled with surface-plowed land, different times of seeding, and testing a number of varieties. A severe frost during the latter part of November interfered materially with the results. Work along this line has been reported in Bulletin 59 of the station (E. S. R., 8, p. 594).

An acre plat, which was in wheat continuously for seventeen years without manure, gave an average yield of 19.57 bu. per acre for the period. During this period three crops were complete failures and two others but little short of failures owing to winterkilling.

An experiment with subsoiled and surface-plowed plats resulted in lighter yields on the subsoiled plats. Another experiment in this line, and in continuation of one formerly reported (E. S. R., 8, p. 594), resulted generally in smaller yields on plats subsoiled in 1894 than on plats which had been only surface plowed. The experience of the college farm with subsoiling for wheat and corn indicated that there is a positive loss of labor and yield by subsoiling.

The comparison of different dates of seeding showed that in general the best results were obtained from seedings made from September 7 to 21. On the average the seeding of September 16 made the best showing.

The rotation experiments have not been in progress long enough to warrant definite conclusions. They have shown, however, that a yearly application of 20 tons of barnyard manure per acre causes an excessive growth of straw and fails to develop the kernel. This year wheat was sown after some catch crops of soy beans and cowpeas. The best yields were obtained from the wheat seeded on soy-bean stubble.

Out of 57 varieties grown at the station for several years only the Turkey, Tasmanian Red, and Crimean have withstood the severe frosts in November so as to yield at the rate of 10 bu. or more per acre.

The sugar beet in Illinois, P. G. HOLDEN and C. G. HOPKINS (*Illinois Sta. Bul. 49, pp. 52, figs. 13*).—This bulletin reports the results

of culture experiments with sugar beets carried on at the station and throughout the State, gives instructions for sugar-beet culture, discusses other points of interest in this connection, such as the cost of production of the beets and their manufacture into sugar, and points out how Illinois is adapted to the production of beet sugar. The results of the experiments, meteorological data from 1889 to 1897, inclusive, and statistics for various beet-sugar producing countries are given in tables.

At the station the original Kleinwanzleben gave the best results. The beets averaged over 1 lb. in weight and contained about 15 per cent of sugar with a purity of 85. Improved Kleinwanzleben and Short French gave satisfactory results, while Long French was medium in quality. In no case did the sugar in the juice fall below 12 per cent or the coefficient of purity below 80. Analyses made of beets harvested weekly for a period of ten weeks, beginning September 14, showed that in general there was an increase in the sugar content and the purity as the season advanced. Plowing 8 and 10 in. deep showed no marked difference in the results, but samples from land subsoiled 16 in. deep were lower in purity than samples from unsubsoiled plats. Beets grown in rows 15, 18, 22, 28, 36, and 44 in. apart decreased in sugar content and purity as the distance between the rows increased.

The sugar beet in Indiana, H. A. HUSTON and J. M. BARRETT (*Indiana Sta. Bul. 68, pp. 32, figs. 13*).—This bulletin discusses the method of growing sugar beets, the necessary climatic conditions, the factory requirements, and the results of cultural experiments made in the State in 1897. Meteorological data and analyses of beets grown in 35 different counties are tabulated. The results of the analyses show a wide range, but in every county from which more than one sample was received, beets of a satisfactory character were produced. In very many cases the work was not properly done and many samples were received from parties who did not get their seed from the station and who had no knowledge of the proper methods of sugar-beet culture. "What has been accomplished already seems to indicate that, taking everything into consideration, Indiana will be found admirably adapted to the production of the sugar beet, but the fact is not yet proven."

Sugar-beet investigations, J. L. STONE, L. A. CLINTON, G. C. CALDWELL, G. W. CAVANAUGH, ET AL. (*New York Cornell Sta. Bul. 143, pp. 493–571, figs. 9*).—This bulletin contains general remarks on sugar-beet cultivation and reports of fertilizer experiments and cooperative culture tests with sugar beets. Notes are given on the condition and preparation of the soil, seeding, thinning, tillage and harvesting the crop.

Fertilizer experiments were made at the station to determine the effect of different fertilizers on the yield and quality of sugar beets. The plats, 14 in number, were 4 by 5 ft. in size, each surrounded by a brick and cement wall to avoid the transportation of fertilizer material from one plat to another. For three years previous the soil had been

cropped heavily without the application of any fertilizer. The different fertilizers were applied singly and in various combinations. Kleinwanzlebener seed was planted May 19 and later on the beets were thinned to 28 plants per plat. Analyses were made October 4, 9, and 20 and November 6 and 27, and in general it may be said there was an increase in the sugar content and purity from the first to the last analysis. The largest yield was obtained from the application of untreated phosphate rock, the highest percentage of sugar from the application of muriate of potash, and the highest coefficient of purity from the use of a complete fertilizer; but, on the whole, the effect of the various fertilizers was not very marked.

Cultivating beets five or seven times during the season gave practically the same results; and cultivating weekly from June 1 to September 5 indicated no appreciable gain over cultivating once every two weeks during the same period.

The analysis of samples from the cooperative experiments is described in detail and the results are given in tabular form. Analyses of the upper and lower halves of beets showed that the upper halves were richer in sugar, while the purity, with one exception, was higher in the lower. It was found that in pressing beet pulp the juice which first ran from the press was lower in sugar content and purity than that from the last part of the operation; hence the authors advise when making analyses to express as much as possible from the pulp. Analyses of 112 samples of beets grown on sandy loam averaged 16.66 per cent of sugar in the juice, with a purity coefficient of 83.1; while 109 analyses of beets grown on clay loam gave an average sugar content of 17.29, with a purity coefficient of 83.8. The distance between rows had no effect on the quality of the beets. Plats which had received barnyard manure the previous year produced beets higher in sugar content and purity than plats which had received barnyard manure the same season the beets were grown. The effects of previous crops, as pointed out, are in favor of untilled grain crops as compared with hay, potatoes, corn, and cabbage, but the difference in the quality of beets grown after these crops was small. A series of analyses, made to determine the influence of size of beet on sugar content and purity, showed that in general the smaller the beet when matured the higher the sugar content and coefficient of purity. Beets ranging from 1¼ to 2 lbs. are considered to be most profitable.

In one experiment the crowns were removed from the beets and analyzed separately. The seven analyses reported show on an average a sugar content of 12 per cent and a coefficient of purity of 73.07 for the crowns, and a sugar content of 13.9, with a purity coefficient of 80.4, for the beets below the crown.

The following table is based on the results of experiments:

Relative amounts of leaves, crowns, and crownless beets per ton of whole crop and the content of plant food.

	Proportion of parts.	Composition of parts.		
		Nitrogen.	Potash.	Phosphoric acid.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Fresh leaves	520	3.33	5.67	0.59
Crowns	340	1.46	1.53	.41
Fresh crownless beets	1,140	3.19	4.10	1.28
Total	2,000	7.98	11.30	2.28

The composition and production of sugar beets, L. L. VAN SLYKE, W. H. JORDAN, and G. W. CHURCHILL (*New York State Sta. Bul. 135, pp. 513–572*).—This bulletin discusses the conditions required for the successful growth of sugar beets and the outlook for the sugar-beet industry in the State of New York, and gives a report of the culture experiments made with sugar beets at the station and in various parts of the State.

About 140 samples of Kleinwanzlebener and Vilmorin Improved beets, grown under favorable climatic conditions in various parts of the State, varied from 12.7 per cent to 19.6 per cent of sugar in the juice, giving an average of 16.1 per cent, with an average coefficient of purity of 82.5. The average weight of one beet was 16.5 oz.

The experiments at the station showed the cost of producing an acre of beets, based on hand labor at $1.25 per day and team at $3.50 per day, and hand labor at 75 cts. and team at $3.00 per day, to be $75.80 and $54.30, respectively. The yield was about 16.25 tons per acre; but for 1,000 lbs. of beets the loss of weight by removing the crowns was 73 lbs., and by washing off the dirt, 49 lbs., giving a yield of 15.1 tons of marketable beets per acre. The beets contained 16 per cent of sugar in the juice, with a coefficient of purity of 81. The average weight of one beet was 12 oz. A portion of the land was fertilized with 250 lbs. of sulphate of potash, 300 lbs. acid rock, 200 lbs. dried blood, and 200 lbs. nitrate of soda per acre, which increased the yield about 6 tons per acre over the unfertilized portion of the field. This increase is considered to pay for at least twice the amount of fertilizer used.

Sugar beets in South Dakota, J. H. SHEPARD (*South Dakota Bul. 56, pp. 32, map 1*).—This bulletin discusses the resources and facilities of South Dakota for the manufacture of beet sugar and gives a report of the cooperative culture experiments with sugar beets for 1897. A description of ten regions of the State, differing from each other in vegetation and crop conditions, is given. Meteorological data for the growing season of 1897, analyses of well water, chemical and mechanical analyses of soils, and the results of sugar beet experiments are

given in tables. The work of previous years in this line is briefly reviewed.

The average sugar content in the juice for the different regions ranged from 14.7 to 19.6, and the coefficient of purity from 81.6 to 87.8. The average for the ten regions was 16.4 per cent of sugar in the juice, with a purity of 85.6. Analyses were made of 951 beets, averaging 383 gm. in weight.

The results of a test of five foreign varieties made at the station are given in a table.

Utah sugar beets, 1897, J. A. WIDTSOE (*Utah Sta. Bul. 53, pp. 87–115*).—In this bulletin the mean temperature and the precipitation at the station for each month for the years 1891 to 1897, inclusive, and the results of cooperative culture experiments with sugar beets are given in tables. Of the samples analyzed 211 were grown in eight different counties, 4 were received from Idaho, and 54 were taken from the station farm. These 269 samples showed an average of 14.24 per cent in the juice, with a purity coefficient of 83.1.

Field experiments, C. D. SMITH (*Michigan Sta. Rpt. 1896, pp. 110–114*).—An outline is given of experiments conducted on the college farm during the year. The details are published in other publications of the station (E. S. R., 8, pp. 882, 883; 9, p. 131).

Subsoiling experiments (p. 114).—Of three plats of sandy soil the first was plowed 4 in. deep, while the other two were plowed 8 in. deep, but one of these was subsoiled 6 in. below the furrow. In 1895 and 1896 all plats were planted to corn. The second year the depth of plowing for all plats was 6 in. The first year was unusually dry, while the second year was unusually wet. The subsoiled plat produced a slightly better yield than the plat not subsoiled in 1895, but the second year there was no apparent gain.

In addition the article contains accounts of dynamometer tests and observations on the shrinkage of cord wood (p. 195).

On the possibility of improvement of agricultural plants, H. NILSSON (*Ber Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 454–457; II, App. 16, pp. 40, ill.*).

Report of the Department of Agriculture, New Brunswick, 1897, C. H. LABILLOIS (*Rpt. on Agr. for New Brunswick, 1897, pp. 1–100*).—The crops of 1897 under general cultivation in the province are briefly described and the meteorological data for the season tabulated. The reports and accounts of 51 agricultural societies for the year are given.

Planting at different depths, P. G. HOLDEN, F. P. CLARK, and A. A. CROZIER (*Michigan Sta. Rpt. 1896, pp. 200, 201*).—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 395).

Alfalfa, H. HITIER (*Jour. Agr. Prat., 62 (1898), No. 17, pp. 601–603*).—An article discussing the extent of alfalfa culture in France and the value of the crop as a feeding stuff.

Alfalfa, A. A. CROZIER (*Michigan Sta. Rpt. 1896, pp. 197, 198*).—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 396).

Variations in the hereditary ability of certain characters in the hybridization of barley, P. BOLIN (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, II, App. 11, pp. 12*).

Studies on variation and improvement, with special reference to Goldthorpe barley, W. JOHANNSEN (*Ugeskr. Landm., 43 (1898), No. 11, pp. 140–142*).

American red clover (*Fühling's Landw. Ztg., 47 (1898), No. 5, pp. 237–239*).

Crimson clover in Michigan, A. A. CROZIER (*Michigan Sta. Rpt. 1896, pp. 171–180*).—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 382).

Bokhara clover (Melilotus altissimus) (*Deut. Landw. Presse, 25 (1898), No. 32, p. 350*).

The common names of the clovers, A. A. CROZIER (*Michigan Sta. Rpt. 1896, pp. 182–196*).—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 396).

Clover sown every month in the year, A. A. CROZIER (*Michigan Sta. Rpt. 1896, pp. 181, 182*).—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 396).

Detasseling corn, C. D. SMITH, A. A. CROZIER, and J. T. BERRY (*Michigan Sta. Rpt. 1896, pp. 205–208.*)—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 383).

Cattle ranges of the Southwest: A history of the exhaustion of the pasturage and suggestions for its restoration, H. L. BENTLEY (*U. S. Dept. Agr., Farmers' Bul. 72, pp. 32, figs. 9*).—This is a popular bulletin in which the early use and present condition of Texas pastures are described, methods of how to renew the stock ranges suggested, and the obstacles to be overcome in their renewal pointed out. Descriptive notes are given on the following promising grasses and forage plants native in the Southwest: Bermuda grass (*Cynodon dactylon*), black grama (*Hilaria mutica*), buffalo grass (*Bulbilis dactyloides*), Colorado grass (*Panicum texanum*), curly mesquite (*Hilaria cenchroides*), ground plum (*Astragalus crassicarpus*), needle grass (*Aristida fasciculata*), side-oats grama (*Bouteloua curtipendula*), stolley vetch (*Vicia leavenworthii*), tallow weed (*Actinella linearifolia*), western wheat grass (*Agropyron spicatum*), blue grama (*Bouteloua oligostachya*), and wild bean (*Phaseolus helvolus*). "Native grasses are by far the best for home use. They are suited to the climate and the climate is suited to them."

Profitable fodder crops, C. H. GORMAN (*Agr. Gaz. New South Wales, 9 (1898), No. 3, pp. 281–283*).—Popular notes on alfalfa and sorghum.

Potash and phosphoric acid fertilizers for meadows, A. RINDELL (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 312–320*).

Hops, R. H. MCDOWELL (*Nevada Sta. Bul. 35, pp. 24*).—This is a popular bulletin on hop culture, with general directions for the cultivation, harvesting, curing, packing, and marketing of the crop.

Characteristics of various lupine varieties (*Deut. Landw. Presse, 25 (1898), No. 40, pp. 436, 437, figs. 11*).—Seven varieties of lupines are described.

Modiola (*Pacific Rural Press, 55 (1898), No. 19, p. 289*).—Notes on this forage plant, newly introduced from Chile into California. The plant has been identified as *Modiola decumbens*.

The oats supply of the United Kingdom (*Jour. Bd. Agr. [London], 5 (1898), No. 1, pp. 25–28*).

Potatoes, L. R. TAFT (*Michigan Sta. Rpt. 1896, pp. 341–349*).—A reprint from Bulletin 131 of the station (E. S. R., 8, p. 216).

Raising rice without water (*Jour. Jamaica Agr. Soc., 2 (1898), No. 5, p. 203*).—A short note on this method of rice culture.

The beet sugar industry and its development in California, E. W. HILGARD (*Pacific Rural Press, 54 (1897), No. 22, p. 341*).—A discussion of sugar beet culture and factory operations in the manufacture of beet sugar, with notes on the development of the industry.

Cultivation of the soil for sugar beets (*Pacific Rural Press, 55 (1898), No. 19, p. 292*).—Popular notes on preparation and cultivation of the soil for sugar beets in southern California.

The sunflower (*Jour. Jamaica Agr. Soc., 2 (1898), No. 5, pp. 184–186*).—Directions for the cultivation and utilization of sunflowers are given in a popular manner.

Tobacco culture, W. SAUNDERS (*Canada Cent. Expt. Farm Bul. 30, pp. 14*).—This bulletin contains historical notes on the tobacco plant and directions for its culture.

The methods of cultivating and harvesting the crop and preparing it for market are discussed and insect remedies suggested. Some of the earliest and best yielding varieties tested at the Central Experimental Farm are White Burley, Connecticut Seed Leaf, Pennsylvania Seed Leaf, Pryor Yellow, Climax, Yellow Mammoth, Oronoko Yellow, Safrano, Brazilian, and Canadian.

Tobacco as a perennial, W. DAROCZI (*Jour. Jamaica Agr. Soc., 2 (1898), No. 5, pp. 197-199*).—It is reported that tobacco can be grown as a perennial and that each succeeding crop is heavier and of better quality when so grown.

Methods of curing tobacco, M. WHITNEY (*U. S. Dept. Agr., Farmers' Bul. 60, pp. 15*).—A revised edition (E. S. R., 9, p. 718).

Fodder turnips, H. L. DE VILMORIN (*Jour. Agr. Prat., 62 (1898), No. 22, pp. 790-792, pl. 1*).—A popular article on fodder turnips, with notes on the principal varieties.

The cultivation of grain, G. HEUZÉ (*Jour. Agr. Prat., 62 (1898), No. 18, pp. 647-649*).—A discussion on the cultivation of drilled grain during the period of growth.

Four years variety tests with winter wheat, A. SEMPOLOWSKI (*Deut. Landw. Presse, 25 (1898), No. 38, p. 412*).—Tabulated reports of the experiments are given, with notes on the different varieties.

Harvesting wheat at successive stages of ripeness, P. G. HOLDEN and L. J. BRIGGS (*Michigan Sta. Rpt. 1896, pp. 202-204*).—A reprint from Bulletin 125 of the station (E. S. R., 7, p. 395).

Manuring of our modern highly improved varieties of wheat, M. MAERCKER (*Braunschw. Landw. Ztg., 56 (1898), No. 18, p. 77*).—A discussion of the results of fertilizer experiments and variety tests. The newly improved square head varieties of wheat gave better results than the older square head varieties.

Rotation of crops (*Agr. Jour. Cape of Good Hope, 12 (1898), No 7, pp. 365-369*).—A general discussion on crop rotations with special reference to seven and four year systems.

HORTICULTURE.

Vegetable growing, S. C. MASON and W. L. HALL (*Kansas Sta. Bul. 70, pp. 135-162, pls. 5*).—Detailed directions are given for the construction and use of hotbeds and cold frames.

The results obtained in the cultivation of the cauliflower at the station are given. Manure applied to the soil at the rate of 50 loads per acre before setting the plants did not increase the yield very noticeably. Figures are given illustrating the tendency of cauliflower to form compact white heads during the cool part of summer and to form less compact dark colored heads during the warm weather later in summer. Early Snowball cauliflower matured earlier, produced more and larger heads than the Early London, and the heads were of better quality.

Methods of growing cabbage to get early maturity are reported. By one method the plants are started in the fall and kept in protected cold frames over winter. By another method they are started in winter in the greenhouse or hotbed.

A table is given comparing the yield of ten varieties of asparagus on manured and unmanured soil. The varieties giving the greatest yield were the Hub and Donald Elmira. A fairly successful method of forcing asparagus under greenhouse benches is described. Of the varieties forced Donald Elmira gave best results.

A method followed by English gardeners to increase the earliness of potatoes was tested. The tubers were packed in sand in greenhouse flats with the "seed" end exposed above the sand. The flats were placed under the bench in a cool propagating house late in February. A month later, when the tubers had sprouted, they were set in furrows in the field in the same position they had in the flats. At the same time unsprouted tubers were planted as a check. Tables are given showing the comparative yield of ten hills of the sprouted and unsprouted lots dug June 16 and of the remainder dug July 24. The authors say "it will be observed that the proportional difference is greater with the early digging than the later, and that the difference in the ripe tubers would not be sufficient to make the experiment pay for the trouble. The real gain was found in the examination made June 1, which gave table potatoes a week ahead of the ordinary method."

In 1893 a large number of varieties of onions were tested, of which Prize Taker gave the best results. In 1894 a fertilizing experiment was made with onions. A heavy application of barnyard manure gave better results than any of the more concentrated fertilizers. In 1895 tests of subsoiling and irrigating were made in connection with onions. The yield of onions on a subsoiled and unirrigated plat was about 103 lbs.; on an irrigated and nonsubsoiled plat, 167 lbs.; on a plat neither irrigated nor subsoiled, 173 lbs.; and on a plat both subsoiled and irrigated, 244 lbs. In 1896 the experiment was continued, but thrips ruined the crop entirely. In 1897 a comparison of the old *vs.* the new onion culture was made. The yields by the two methods are given in a table. No conclusions are drawn. Most of the onions were of inferior size, owing to injury from thrips.

A test was made of different grades of soil for forcing lettuce. The soil varied from poor garden loam to a mixture of one-fourth sand and three-fourths garden loam. A number of plantings were made. The earliest plantings gave the best results in the mixture of half sand and half loam, the next later planting gave best results in soil one-fourth sand and three-fourths loam, and the latest planting gave best results in the poor loam. A test was also made of varieties. Bartelde Denver Market gave the heaviest heads, Grand Rapids next heaviest, and Black Seeded Simpson lightest. Plants set 6 by 6 in. apart gave a greater yield per square foot of bench than plants set 8 by 8 in.; but the average weight of the heads was considerably less in the former case than in the latter.

The method of forcing tomatoes at the station is given, and the treatment of Œdema considered. The yield from 30 plants of each of the following varieties was: New Stone, 86.5 lbs.; Fordhook First, 66.5 lbs.; Royal Red, 65.7 lbs.; Dwarf Champion, 60.3 lbs.

Watermelons, H. N. STARNES (*Georgia Sta. Bul. 38, pp. 67–103, pls. 3, figs. 5*).—The bulletin discusses watermelon culture, including soils, fertilizers, planting, cultivation, gathering, marketing, seed saving,

insect enemies, varieties, and similar topics; reports the results of fertilizer and variety tests in 1895 and 1897, and describes 40 varieties.

The results of fertilizer and variety tests are given in tables. The results of the fertilizer test of 1895 were not conclusive on account of irregularities in the land on which the plants were grown. In 1897, superphosphate, nitrate of soda, cotton-seed meal, muriate of potash, and kainit were used in varying amounts and in different combinations. In the author's opinion, the results of this work, though much more conclusive than the previous work, are not altogether satisfactory. A moderate amount of fertilizers gave better results than a larger amount. As a source of nitrogen, nitrate of soda gave a larger early yield, a greater total yield, and somewhat larger fruit than cotton-seed meal. In a similar way, muriate of potash proved superior to kainit as a source of potash.

In 1895 25 varieties and in 1897 30 varieties of watermelons were tested. The data obtained are recorded in tables. The results of the two years were very different. For instance, the variety (Lord Bacon), which in 1895 ranked first in yield and second in size, in 1897 dropped to twenty-first in yield and sixth in size, while Augusta Sugar Loaf, which in the former test ranked twenty-third in yield and twenty-first in size, in the latter test ranked second in yield and seventeenth in size.

Strawberries: Cultural notes and variety tests, W. J. GREEN (*Ohio Sta. Bul. 85, pp. 24, pls. 3*).—The author believes that while good varieties are of the utmost importance to strawberry growers, and while the highest standards have not been reached, nevertheless there is danger of making the variety question too prominent. Intensive culture should be given more attention. To secure the finest berries where sufficient water is at hand, summer planting is recommended. The plants are set in triple rows in imitation of the matted row. By thinning beds set in the spring, plants can be obtained for the summer planting.

Notes are given on 70 varieties of strawberries, summarizing the behavior of each for the whole time it has been on trial at the station. The following varieties are recommended for general culture: Bubach, Brandywine, Greenville, Haverland, Lovett, and Warfield. The most promising new varieties are: Aroma, Anna Kennedy, Beauty, Copernicus, Clyde, Carrie, Enormous, Glen Mary, Hall Favorite, Portage, Ruby, Rio, Staples, Tennessee Prolific, and three unnamed seedlings.

Practical advice on the hybridization of the grape, P. CASTEL (*Prog. Agr. et Vit., 29 (1898), No. 15, pp. 462–468*).—This is a summary of a series of articles on the hybridization of grapes.

In regard to the choice of parent plants for hybridizing the author gives the following rules:

(1) Plants should be chosen which present in the greatest degree possible those characteristics desired in the resulting hybrid. (2) The

parent plants should be hybridized in such way as to utilize the characteristics of each to the best advantage; for instance, to obtain direct producers, American species of grapes should be pollinated by French grapes, while to obtain stocks for grafting the reciprocal hybrid should be obtained. (3) Parent plants should be chosen which will give the maximum of variation to the seedlings. (4) In the production of hybrids or crosses the maximum of vigor and fertility should be maintained by the constant introduction of unrelated species or varieties.

The problems of modern viticulture, the author says, are as follows:

(1) To obtain new stocks for grafting, which shall exhibit great resistance to phylloxera, adaptation to calcareous soils, affinity for scions of French grapes, and such other characters as tend to facilitate their culture; (2) to obtain direct producers, which shall show great resistance to phylloxera, adaptation to the soil to be used, a high sugar content, fruitfulness, early maturity, resistance to fungus diseases, fruit of good quality and color, and any characteristic facilitating their culture; (3) to obtain new varieties resistant to black rot.

Report of the horticulturist, L. R. TAFT (*Michigan Sta. Rpt. 1896, pp. 114–119, charts 3*).—This report gives general outlines of the work of the department during the year, the results of the various experiments being published in bulletin form. The arrangement of orchards at the station and substation is described and illustrated by charts.

Education of horticulturists, L. R. TAFT (*Michigan Hort. Soc. Rpt. 1896, pp. 220–226*).

Cocoa culture in Samoa, H. J. MOORS (*U. S. Consular Rpts. 1898, No. 212, pp. 65–68*).

Market gardening with limited capital, H. W. COLLINGWOOD (*Massachusetts State Bd. Agr. Rpt. 1897, pp. 65–94*).

New creations in the vegetable kingdom, D. W. BEADLE (*Canad. Hort., 21 (1898), No. 6, pp. 217–224, pl. 1, figs. 8*).—Remarks on how improvement of plants is effected and examples of results secured in the improvement of plants by the horticulturists of Ontario.

Rotations in vegetable gardening, A. MAGNIEN (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1898, pp. 22–35*).

Rotations in vegetable gardening, J. FOUSSAT (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1898, pp. 36–51*).

Rotations in vegetable gardening, E. ZACHAREWICZ (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1898, pp. 52–57*).

Rotations in vegetable gardening, J. LAVIALLE (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1898, pp. 58–63*).

On the improvement of peas, H. TEDIN (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, II, App. 12, pp. 25*).

Horse-radish, M. G. KAINS (*U. S. Dept. Agr., Division of Botany Circ. 15, pp. 8*).—A discussion of the culture, uses, enemies, yield, and profits of horse-radish.

The history of the radish, G. HENSLOW (*Gard. Chron., 3. ser., 23 (1898), No. 600, p. 389*).

Vegetable tests, H. P. GLADDEN and U. P. HEDRICK (*Michigan Sta. Rpt. 1896, pp 350–374*).—A reprint from Bulletin 131 of the station (E. S. R., 8, p. 225).

The apple orchard, L. R. TAFT (*Michigan Sta. Spec. Bul. 4, pp. 1–12*).—A popular bulletin giving suggestions for the culture of apples.

Grafting the apple (*Nat. Nurseryman, 6 (1898), No. 5, p. 63*).—A reprint from E. S. R., 9, p. 750.

English orchards (*Jour. Bd. Agr.* [*London*], *5* (*1898*), *No. 1, pp. 1–10*).—Notes on the present status of English orchards, with suggestions for their improvement.

Fruit list recommended for general planting in various fruit districts of Colorado (*Colorado Bd. Hort. 1897, pp. 147–152*).

Experiments with orchard cover crops, J. CRAIG (*Michigan Hort. Soc. Rpt. 1896, pp. 275–280*).—The author discusses the relative value of several cover crops as a winter protection to orchards and as green manures. The discussion is based on the results of experiments made at the Central Experimental Farm of Canada, and published in part previously (E. S. R., 9, p. 841).

Future of peach growing in the United States, J. H. HALE (*Michigan Hort. Soc. Rpt. 1896, pp. 287–306*).

Pruning the peach, R. MORILL (*Michigan Hort. Soc. Rpt. 1896, pp. 310–325, figs. 12*).

Relative hardiness of fruit buds of peaches and plums, J. CRAIG (*Michigan Hort. Soc. Rpt. 1896, pp. 361–366*).—This article is also printed in Canada Expt. Farms Rpt. 1896 (E. S. R., 9, p. 841).

About thinning peaches, A. E. MICKLE (*Canad. Hort., 21* (*1898*), *No. 6, pp. 225, 226*).

Thinning Fruit (*California Fruit Grower, 22* (*1898*), *No. 22, pp. 6, 7*).—A reprint from U. S. Dept. Agr., Farmers' Bulletin 73. (See p. 197.)

Fruits at the agricultural college, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Rpt. 1896, pp. 328–340*).—A reprint of Bulletin 130 of the station (E. S. R., 8, p. 134).

Fruits at South Haven, T. T. LYON (*Michigan Sta. Rpt. 1896, pp. 286–327*).—A reprint of Bulletin 129 of the station (E. S. R., 8, p. 134).

Raising and marketing of fruit, W. F. TABER (*Massachusetts State Bd. Agr. Rpt. 1897, pp. 119–140*).

Evaporation from fruit trees (*Gard. Chron., 3. ser., 23* (*1898*), *No. 597, pp. 337, 338*).—The author reviews the work of J. B. Lawes, L. H. Bailey, and A. L. Kniseley on the evaporation of water from the twigs of trees in winter, and reports observations of his own on the evaporation from twigs of different sizes. The data are tabulated. The loss of water from the large twigs was greater than from the small ones, but the percentage of water lost was practically the same in all cases.

Studies in pollination, J. C. WHITTEN (*Missouri Hort. Soc. Rpt. 1897, pp. 101–103*).—Lists of apples, peaches, plums, cherries, and grapes are given, showing the varieties which fruited and those which failed to fruit when their flowers were covered with sacks.

Fruits of the tropics (*Wiener Illus. Gart. Ztg., 22* (*1898*), *No. 6, pp. 209–213*).

A practical handbook of fruit-tree culture, J. BÖTTNER (*Praktisches Lehrbuch des Obstbaus. Frankfurt, 1898, pp. 574, figs. 557*).

Small fruits in the home garden, S. T. MAYNARD (*Massachusetts State Bd. Agr. Rpt. 1897, pp. 225–237, figs. 3*).—Suggestions regarding culture of small fruits.

Strawberries, L. C. CORBETT (*West Virginia Sta. Bul. 52, pp. 88–110, pls. 3*).—Directions for the culture of strawberries are given and the results of variety tests in the years 1896 and 1897 are reported. The data obtained are given in tables. The rank of the different varieties as to size of fruit and productiveness for both years is shown by tables and by a chart. Descriptive notes are given on the varieties tested and a typical fruit of each is illustrated.

Irrigation of grapes, B. CHAUZIT (*Prog. Agr. et Vit., 29* (*1898*), *No. 23, pp. 698–705*).

Self-sterility among cultivated grapes, S. A. BEACH (*Michigan Hort. Soc. Rpt. 1896, pp. 64–68*).—The data on which this paper is based were published in the Annual Report of the New York State Station for 1895 (E. S. R., 9, p. 52).

Obervations during 1892-1897 at the viticultural station of Neauphle-le-Chateau, P. MOUILLEFERT (*Ann. Agron., 24* (*1898*), *No. 5, pp. 215–253*).

Viticulture and vinification in the province of Salta (*La viticultura y la vinificacion en la Provincia Salta. Buenos Ayres, 1897, pp. 69, pls. 7*).

Azaleas for forcing, R. M. GREY (*Florists' Exchange, 10* (*1898*), *No. 19, pp. 480, 481*).—Notes on culture and varieties of azaleas.

The chrysanthemum: Its culture and management, T. D. Hatfield (*Amer. Gard., 19 (1898), No. 180, Sup., pp. 10, 11*).

Single chrysanthemums (*Garden, 53 (1898), No. 1381, pp. 386, 387, pl. 1*).

Clematis (*Amer. Gard., 19 (1898), No. 178, pp. 390, 391, figs 2*).—Notes on various species.

Improvement of the gladiolus, H. H. Groff (*Michigan Hort. Soc. Rpt. 1896, pp. 106, 107*).

Crossing hellebores, T. H. Archer-Hind (*Garden, 53 (1898), No. 1385, pp. 474, 475, pl. 1, fig. 1*).—Notes on the author's experience in crossing hellebores.

How to make a lawn, H. C. Irish (*Missouri Hort. Soc. Rpt. 1897, pp. 87–91*).

Selection in its relation to horticulture, C. L. Allen (*Florists' Exchange, 10 (1898), No. 24, p. 599*).—A paper read before the Eastern New York Horticultural Society.

Ornamental trees and shrubs of the open air cultivated for their flowers, A. Charquerand (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1898, pp. 113–123*).

Ornamental trees and shrubs of the open air cultivated for their flowers, C. Baltet (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1898, pp. 124–141*).

Shrubs and their propagation (*Florists' Exchange, 10 (1898), Nos. 18, p. 462; 19, p. 485; 20, p. 500; 23, pp. 574–575*).

Park woodlands and plantations, J. W. Pettigrew (*Amer. Florist, 13 (1898), No. 520, pp. 1423, 1424*).—A paper read before the Park and Out-door Art Association.

New evergreen hybrids from Rosa wichuraiana, R. M. Grey (*Florists' Exchange, 10 (1898), No. 25, p. 623*).

Systems and types of the ornamentation of gardens and their application, A. Maumené (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1898, pp. 6–21*).

Residential sites and environments; their conveniences, gardens, parks, planting, etc., J. F. Johnson (*New York: A. T. DeLamare, 1898, ill.*).—The book is divided into three parts. Part 1 treats of residential sites and environments, including such topics as thinning out woodlands, model home ground, beauties of plant life, special effect of trees and shrubs and of carpet plants. Part 2 is planting and introduction to undulations, and treats of planting and transplanting trees and large plants, mass planting, grouping in boundaries, planting borders, herbaceous garden, rockeries, aquatic and bog garden, perpetual effects, etc. Part 3 treats of villa gardens and public grounds under such heads as small gardens, corner lots, planting a church front, locating entrance roadways, planting a small garden, making the most of the back, a town square, etc.

Some 50 plans and diagrams are given.

DISEASES OF PLANTS.

Notes on some peach diseases, L. R. Taft (*Michigan Sta. Rpt. 1896, pp. 120–124*).—Notes are given on peach yellows, "little peach," root galls, and a gum disease of the peach.

The author calls attention to the fact that, while peach yellows is still prevalent in the State, by frequently cutting out the diseased trees the loss is reduced very materially, numerous instances being reported where not more than one tree in a thousand is annually condemned. Brief notes are given on spraying for the prevention of peach yellows; but, while the use of fungicides may have a beneficial effect on the general health of the trees, there is no evidence to show that it will prevent attacks of peach yellows. Numerous cases are given which may lead to a mistaken identification of peach yellows. Among

the principal ones are dry, hot weather, attacks of borers, overbearing lack of plant food, etc.

Under the name of "little peach" the author describes a disease which apparently is of unknown cause. The unhealthy trees were found on all kinds of soil, and as a rule but few trees scattered through an orchard were attacked. The diseased trees live for a number of years and in some cases make a partial recovery. The author has been unable to identify any fungus or bacteria with the disease, nor is he able to ascribe it to any positive cause. He thinks possibly cold weather in the fall or spring, following a season in which growth was continued late into the autumn, may bring about this trouble. An opportunity was offered in the spring of 1896 to test this theory. Some of the diseased trees examined showed an abnormal growth of wood for the season of 1893. Directions were given that these trees be cut back so as to remove the wood that had apparently been injured and thus form a new head from shoots that would be sent out below. Three trees which the owner thought "would die anyway" were thus pruned. They formed good heads during the summer and the following fall they were apparently the healthiest trees in the orchard. In other cases where the pruning was not sufficient to remove the injured wood "the benefits of the heading back were quite marked, but as the new shoots had to draw their nourishment through the injured tissue the results were less marked." The author states that in the case of 4-year-old trees under high cultivation the injury seemed to be about overcome in two years. A number of experiments have been undertaken with commercial fertilizers and it is said that in every case benefits can be seen from their use.

Brief notes are given on the occurrence of root galls on peaches, the galls being attributed to various causes, and, since such affected stock is worthless, the author advises against planting it.

Attention is called to the exudation of gum from the tissues of peach trees that have been injured by brown rot or other causes. Where patches of gum are numerous or large, it is recommended that the branches be cut off below the spots and proper attention given the trees to develop new shoots and ripen their wood.

The grain smuts: How they are caused and how to prevent them, W. T. SWINGLE (*U. S. Dept. Agr., Farmers' Bul. 75, pp. 20, figs. 8*).—The substance of this bulletin has already appeared as Farmers' Bulletin 5 and in an article by the author in the Yearbook of this Department for 1894. The different smuts of grain are described and various treatments suggested for their prevention. A new fungicide for the prevention of oat smut is mentioned which, as the author says, has not yet been extensively tested for smuts, but it is thought it will prove effective. This fungicide, to which the name "Sar" solution has been given, consists of a mixture of flowers of sulphur, resin, caustic soda, and water. The formula given produces a sticky solution which

must be kept in tightly corked jugs or in closed barrels or casks. When ready for use, $1\frac{1}{2}$ pt. of the solution is added to 50 gal. of water and the seed soaked for 24 hours.

A bacterial rot of cabbage and allied plants, H. L. RUSSELL (*Wisconsin Sta. Bul. 65, pp. 39, figs. 15*).—This bulletin gives the completed results of the investigations of the author and his assistants, H. A. Harding and F. Cranefield. A sketch of this work was presented by the author in a paper read before the Association of American Agricultural Colleges and Experiment Stations, 1897. The author's investigations of this disease were conducted at the same time as those of E. F. Smith, which have been previously noted.[1] The conclusions of the two authors practically agree in the cause of the disease, biology of the organism, and methods of prevention.

Plant diseases in Holland, C. A. J. A. OUDEMANS (*K. Akad. Wetten. Amsterdam, 1897, June 26; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 1, p. 33*).—The author reports young peas attacked by *Brachyspora pisi*, n. sp.; leaves of rye affected by *Marsonia secalis*, n. sp.; gooseberries attacked by *Hendersonia grossulariæ*, n. sp.; and buckwheat by *Fusicladium fagopyri*, n. sp. In addition to these new species the following are noted: *Ascochyta graminicola* on young rye, *Botrytis cinerea* on leaves and branches of *Prunus cerasus*, *Scolecotrichum melophthorum* on fruits and vines and melons, *Macrosporium parasiticum* on shallots, *Cladochytrium graminis* on oats, and *Helminthosporium gramineum* Rabh., which is said to be identical with *H. teres* Sacc. and *H. gramineum* Eriks., on winter rye.

Notes on plant parasites, G. WAGNER (*Ztschr. Pflanzenkrank., 8 (1898), No. 1, pp. 7–10*).—Notes are given of a number of parasitic fungi. Among them are a number of Uredineæ—*Cystopus candidus, Plasmopara viticola, Brema lactucæ*, etc.

Club root of cabbage, B. D. HALSTED (*Amer. Gard., 19 (1898), No. 177, p. 373, fig. 1*).—A brief account is given of experiments made to determine the susceptibility of cabbages to the fungus *Plasmodiophora brassicæ*. It is shown that the first three weeks of the life of the plant is the period of greatest susceptibility. On this account seed beds should be looked after very carefully. Lime at the rate of 35 bu. per acre will destroy the fungus in the soil.

Finger and toe (club root) of swedes and turnips (*Gard. Chron., 3. ser., 23 (1898), No. 593, pp. 281, 282*).—As a result of experiments carried on at Reading it is said that quicklime, chalk, or gas lime well mixed with soil will greatly lessen attacks of the disease. Basic slag will to some extent do the same. Swedes or turnips should not be grown for about two years on areas that have received lime.

Mycological notes, C. WEHMER (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 5, pp. 189–195, pl. 1, fig. 1*).—The author describes a 2-spored form of *Merulius lacrymans*, fermentation of kidney beans, and a Botrytis disease of the Chinese primula.

A contribution to the biology of Exoascus deformans, VON DERSCHAU (*Landw. Jahrb., 26 (1897), No. 6, pp. 897–901, pl. 1*).

A remarkable gall disease of a North American species of Abies in the Berlin Botanic Garden, P. HENNINGS (*Verhandl. Bot. Ver. Prov. Brandenburg, vol. 37, p. 26; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 1, pp. 39, 40*).—*Pestalozzia tumefaciens*, n. sp. from *Abies nobilis* is described.

Bean canker, G. MASSEE (*Gard. Chron., 3. ser., 23 (1898), No. 594, p. 293, fig. 1*).—A disease of French beans and scarlet runners is figured and described. The cause is said to be *Glœosporium lindemuthianum*.

[1] Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 11–12, pp. 284–291; 15–16, pp. 408–415; 17–18, pp. 478–486. U. S. Dept. Agr., Farmers' Bul. 68, pp. 22 (E. S. R., 9, p. 847, 849).

Studies on potato diseases, C. WEHMER (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 23–24, pp. 640–658; 25–26, pp. 727–743, pls. 2*).—Experimental studies are reported on Phytophthora and Fusarium diseases. In addition to *Fusarium solani*, the author states that *F. moschatum* and *Spicaria solani* attack the potato and produce symptoms quite like the ordinary Fusarium disease.

Investigations concerning a new potato disease, K. SAJO (*Prometheus, 1898, No. 3, pp. 136–140*).

Potato scab and its prevention, HOLLRUNG (*Ztschr. Naturw., 70 (1898), No. 3, pp. 226, 227*).

Experiments in soaking seed potatoes for the prevention of scab, TEICHERT (*Ztschr. Spiritusind., 21 (1898), No. 13, p. 119*).

Experiments in the repression of potato scab, T. PEMY (*Ztschr. Spiritusind., 21 (1898), No. 7, pp. 57–59*).

Phytophthora infestans and the potato rot, E. ROZE (*Bul. Soc. Mycol. France, 14 (1898), No. 2, pp. 58–69*).

A new generic type of Schizomycetes, E. ROZE (*Bul. Soc. Mycol. France, 14 (1898), No. 2, pp. 69–74, pl. 1*).—The author characterizes a new genus of Schizomycetes, to which the name *Chatinella scissipara* is given. It was found in decaying tulip leaves and in the parenchyma of potatoes.

Culture experiments with heterœcious fungi, H. KLEBAHN (*Ztschr. Pflanzenkrank., 8 (1898), No. 1, pp. 11–30, fig. 1*).—The author reports culture experiments with the æcidia from *Ribes nigrum*, with *Puccinia caricis*, *P. schroteriana*, the æcidia of orchids, and puccinia of *Phalaris arundinacea*, and the specialization of *Puccinia smilacearum digraphidis*, *P. phragmites*, *P. coronata*, *P. dispersa f. secalis*, *P. cari-bistortæ*, and *P. menthæ*.

Recent investigations on the leaf spot of beets, FRANK (*Ztschr. Ver. Rubenz. Ind., 1897, p. 589; abs. in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), No. 25–26, pp. 754, 755*).—The author describes the action of *Cercospora beticola* on beet leaves, and recommends soaking seed for 24 hours in a sort of Bordeaux mixture before planting.

Heterodera radicicola on the roots of Corylus avellana, C. CASALI (*Giorn. Vit. e Enol., 5, No. 6*).

Results of field experiments conducted in 1896 with the wet and dry rots of sugar beets, FRANK (*Fühling's Landw. Ztg., 46 (1897), No. 22, pp. 663–672*).

Trials of methods of combating smut in barley, G. GROTENFELT (*Landtbr. Styr. Meddel., 1897, No. 20, pp. 133–140*).—Trials were made with the Jensen hot-water method, Ceres powder, and the carbon bisulphid method.

Investigations on the root disease of grapevines, J. BEHRENS (*Centbl. Bakt. u. Par., 2. Abt., 3 (1897), Nos. 21–22, pp. 584–589; 23–24, pp. 639–645; 25–26, pp. 743–750*).—Studies are given on *Dematophora necatrix* and allied forms.

On the application of fungicides to grapevines, D. MCALPINE (*Ztschr. Pflanzenkrank., 8 (1898), No. 1, p. 11*).—Notes the advantageous use of a 10 per cent solution of sulphuric acid as a wash for the prevention of grape anthracnose.

Effect of temperature on the action of sulphur on grapes (*Ztschr. Pflanzenkrank., 8 (1898), No. 1, pp. 55, 56*).—The best results where sulphur was used to prevent the grape Oidium followed applications made soon after pruning, the temperature being between 25° and 31° C.

Spraying peach trees for peach curl (*Canad. Hort., 21 (1898), No. 6, pp. 236, 237, figs. 2*).—A test of Bordeaux mixture for leaf curl of peaches is noted. Very good results were obtained.

New copper fungicides, L. DEGRULLY (*Prog. Agr. et Vit., 29 (1898), No. 18, pp. 445–447*).—A new fungicide, composed of sulphate of copper 3 kg., lime 1 kg., and desiccated white of egg or dried blood 100 gm., is described. It is claimed for this mixture that it will remain on leaves for months, ordinary rains not washing it off.

On the use of benzin and carbon bisulphid for nematodes, etc., J. RITZEMA-BOS (*Ztschr. Pflanzenkrank., 8 (1898), No. 1, pp. 42–46, fig. 1*).—A description is given of an injector for the use of these insecticides against nematodes, phylloxera, etc.

Turmeric paper as a test for Bordeaux mixture (*Ztschr. Pflanzenkrank., 8 (1898), No. 1, p. 55*).—The use of turmeric paper as a test of the acidity of Bordeaux mixture is recommended.

Fungicides, insecticides, and spraying, J. TROOP (*Indiana Sta. Bul. 69, pp. 35–40*).—Directions are given for the preparation and application of several of the more common fungicides and insecticides, and a sort of spray calendar is also given in which the directions for prevention of fungus and insect attacks are arranged under the names of the host plants.

ENTOMOLOGY.

Report of the apiarist, R. L. TAYLOR (*Michigan Sta. Rpt. 1896, pp. 138–167*).—The author discusses the relation of queens to foul brood, various kinds of section comb foundation, the relation of honey to heat, what becomes of the food, preservation of comb and the rendering of wax, wintering, foul brood, swarming, and natural *vs.* artificial swarms.

To determine whether foul brood is carried by queens, a queen from a badly infected colony was transferred to a perfectly healthy one, with the result that no foul brood was developed—an important result bearing on the possibility of spreading the disease in shipping queens.

The general conclusions arrived at from the experiments with foundation is that the quality of the wax has as much if not more to do with the quality of the foundation than the mode of manufacturing. This suggests questions as to whether the undesirable qualities of the wax come from the honey used in producing it or from the excessive boiling, and whether the quality of the wax can be improved.

A water-bath melting vessel devised by the author for extracting candied honey from comb is described in detail. It consists essentially of an outer upright cylinder made of tin, galvanized iron, or copper, and an inner one 2 or 3 in. less in height and 4 to 6 in. less in diameter. The inner vessel stands on metal supports about an inch from the bottom of the other and so that the space between the two is equal on all sides. A spout provided with a wire gauze guard at its inner end runs from the bottom of the inner vessel through the outer and conducts off the honey as fast as it melts. Each can is provided with a cover and the space between is filled with water.

Experiments were made with a view to determining exactly the point at which heat begins to be detrimental to the flavor and color of honey. The question is important from the fact that in the absence of an extractor heat has been employed for extracting. In the first experiment honey was heated in a water bath and samples removed at 145°, 165°, 185°, 200°, and 202° F. The first sample showed no effects whatever, and the differences between the first and second were so slight as to give rise to conflicting decisions. The differences between the second and third were twice as great as between the first and second, and it was noted that in heating to 165° the honey rapidly deteriorated both in flavor and color. The differences between the third and fourth were twice as great as between the second and third and between the fourth and fifth there was evidence of a still more rapid deterioration.

Further experiments with candied honey and honey from different plants revealed the fact that the temperature at which liquefaction occurs varies with the kind of honey. Willow herb and basswood honey became limpid at 145°, while alfalfa honey at that temperature became only slightly limpid and no more transparent than before heating. Samples of alfalfa honey taken at 168° and 180° were dissolved, but not limpid. At 194° the honey was fairly clear, but very much injured in color, having become an amber brown. The flavor, however, was but slightly affected. Samples of willow herb honey were nearly water white at 145°. Basswood samples were a little more golden in color. The change in raising from 145° to 180° was nearly the same with each but many shades lighter than alfalfa honey. The change in flavor at 180° was very slight, at 194° it was noticeable and about the same with each sample. Comparing the two extremes it was noted that less change was found to have taken place in samples heated in tin than in those heated in earthenware, but alfalfa honey was injured least in flavor.

The final conclusion is that the difference between the dangei point and the melting point is so great that there is little risk. If the heating is done gradually and as it should be injury scarcely begins before the temperature rises to 170°. The melting of virgin comb with the honey has no effect on color or flavor at any temperature otherwise safe.

An attempt was made to answer the complicated question "What becomes of the feed in feeding for profit, etc.?" The factors which affect this, as the character of the bees and their persistent energy in comb building, etc., the character of the queen, the season, the size and condition of the brood chamber, etc., are considered, and detailed data given of a feeding experiment with three strong colonies of dark hybrid bees for a period of four and a half weeks. The data are discussed at length but no conclusions are drawn.

For the preservation of combs the author has followed four methods: (1) Placing them in hives with strong colonies where the bees might have free access to them; (2) keeping the combs in closed hives in the shop, the hives being placed one above the other, separated by layers of paper and covered with a tight-fitting cover, so that all will keep perfectly dry; (3) hanging the combs up to light and air; and (4) placing the combs in the hives in the bee cellar where the temperature is not sufficiently high for the propagation of the bee moth, provision being made for the exclusion of mice. The first method, where possible, is considered the best and safest although the second has been used with success; the third does well for a season or so, especially if the combs are old and tough, but fresh combs appear to be injuriously affected by light.

In rendering wax the author prefers an open tin vessel 20 in. in height and 24 in. in diameter to the ordinary wax extractor. For combs containing cocoons he uses a rendering tank and prefers a tin

vessel such as is used inside of the ordinary wax extractor and a tin scoop such as is used by grocers. The method of conducting the operation is explained.

Experiments on the relative merits of cellar and out-of-door wintering showed a saving of 9.195 lbs. of stores per colony in cellar as contrasted with out-of-door wintering. Only 3 hives in 120 stored in the cellar were lost from dysentery. For success some stores are necessary, and not less important are temperature and dryness. The author's cellar remained at 45° with a moisture saturation of about 95 per cent; for a drier one it is thought 40° might do.

Concerning foul brood reference is made to the author's report for 1894 (E. S. R., 7, p. 966), to the fasting cure and the drug cure. Where the treatment of colonies must be delayed a mixture of $\frac{1}{4}$ oz. salicylic acid in 1 oz. alcohol and 1 pt. of water added at the rate of 1 pt. to 4 qts. of thin sirup of honey has a decided influence in checking the disease. Fennel (1 part to about 600 parts of the food noted above) is noted, and also burning.

In preventing swarming the author states that he relies on a queen trap so constructed that the queen once in can not return to the hive. In hiving swarms he has been almost entirely successful in meeting the difficulty of large absconding swarms by giving the swarm a double brood chamber and removing the lower section in two days.

Some experiments were made on the amount of food necessary to produce brood. From the figures obtained the conclusion is drawn that almost exactly $2\frac{3}{4}$ lbs. of honey is used up in rearing 1 lb. of brood and that artificial swarms do fully as good work as natural swarms.

The Mexican cotton-boll weevil in 1897, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Circ. 27, 2 ser., pp. 7*).—During 1897 the studies of *Anthonomus grandis* in Texas were continued. The spread of the weevil toward the north and east has been very slow. It is checked by the first frost, and there is some doubt as to whether it will continue beyond the region of volunteer cotton. In rearing experiments undertaken by C. H. T. Townsend at Tobasco, Mexico, where the weevils are common, no parasites were found.

The shortness of the crop in nearly all of the infected region reduced the number of insects so that few were found; but on bottom lands where the cotton was not hurt by the prevailing drought, the weevils were very numerous. They were found to be present at San Antonio, Kenedy, Cuero, Victoria, Beeville, Yoakum, Gonzales, Moravia, Harwood, Shiner, Thompsonville, and Port Lavaca. No great damage is expected for 1898.

In several instances the weevils were found in ginned seed and seed cotton. This fact, which is new, indicates a much greater opportunity for spreading than has hitherto been supposed.

Besides the sharpshooter, formerly reported as being mistaken for this pest, an acorn weevil has been found to produce similar confusion,

A machine for dusting the plants with poison at the rate of 10 acres per hour is noted, and instances cited to show the advantage of domestic fowls as destroyers of the weevil. Otherwise than this the remedies noted are the same as have been given before.

The San José and other scales in Georgia, H. N. STARNES (*Georgia Sta. Bul. 36, pp. 31, figs. 21*).—A popular account of the San José scale and its habits, with special reference to Georgia, together with brief mention of the following scales, more or less common in the State: Florida red scale (*Aspidiotus ficus*), California red scale (*Aonidia aurantii*), English walnut scale (*Aspidiotus juglans-regiæ*), gloomy scale (*A. tenebricosus*), greedy scale (*A. camelliæ*), new peach scale (*Diaspis lanatus*), oyster-shell bark louse (*Mytilaspis pomorum*), long or Glover scale (*M. gloverii*), purple scale (*M. citricola*), and the scurfy scale (*Chionaspis furfurus*).

According to the map showing the distribution of the pernicious scale, it has been found in 22 places in 17 counties, and 17 other places are suspected, making 27 counties in all.

A slight variation in the usual list of food plants for the insect is noted for Berrien County, where it has been found on elm, rose, walnut, black gum, corn, sugar cane, and certain weeds.

The introduction of parasitic and predaceous enemies of the scale as allies for its destruction is mentioned with favor. *Sphærostilbe coccophila*, the twice-stabbed ladybird (*Chilocorus bivulnerus*), and *Pentilia misella* are noted as most effectual, especially the fungus. Both of the ladybirds as adults attack preferably the older, while the larvæ attack the younger scales.

Of the three classes of artificial remedies—total destruction, whale-oil soap, and hydrocyanic-acid gas—thought worthy of note, the first is regarded as the best. The last is not thought a suitable remedy for use by small growers or by any than experienced persons. Two applications of whale-oil soap (2 to 2½ lbs. to the gallon, warm) a month apart, or about the middle of November and again about the middle of December, followed in the spring by several applications of kerosene and water (1 to 15) at intervals of two weeks, is recommended.

Late winter or early spring use of the whale-oil soap in the latitude of Georgia is followed by disastrous results. The method is successful only when the buds are thoroughly dormant, i. e., during December. An emulsion of 8 oz. of ivory or whale oil soap, 1 gal. boiling water, and 1 qt. kerosene used in the strength of 1:15, is recommended, but the simpler remedy of kerosene and water in the proportion of 1:15, applied with the Weed Tank, is thought better. The use of pure kerosene is mentioned, but is not at present recommended.

The gas method is treated at some length with special reference to conditions obtaining in Georgia. A tent weighing only 40 lbs. is described, which can be made at a cost of from $6.50 to $7. The cost of an outfit that can be kept in constant motion by a gang of 4 men is

placed at $84, reckoning the cost of a tent at $7. With such an outfit 192 large 12-foot trees can be treated per night (the best time to work) of 12 hours. Smaller trees would require more tents, but 200 trees per night could be treated. The amount of chemicals required for a 12-foot tree is placed at $4\frac{2}{3}$ fluid oz. of sulphuric acid, 14 of water, and $5\frac{1}{8}$ oz. avoirdupois of 98 per cent potassium cyanid. If the foliage be wet a little more of the chemicals is necessary. This makes a cost per tree of about 4 cts. For treatment of nursery stock a double air-tight chamber is recommended. The time of exposure is placed at at least 45 minutes.

The San José scale and how it may be controlled, J. B. Smith (*New Jersey Stas. Bul. 125, pp. 16, fig. 1*).—The author here gives a summary of observations and conclusions, the details of which are to appear in the Annual Report of the station for 1897.

At the outset no hope of exterminating the scale in the State is held out, although it may be kept within control. The insect is well established along the Delaware River from Burlington to Camden in gardens, orchards, and hedges, and another colony exists at Jersey City Heights where it is believed to have been carried by birds. The country about Parry within a radius of 10 miles contains many infested places. "The entire section of the State north of the red shale line, running obliquely from Trenton on the Delaware to a point north of Perth Amboy on the Kill von Kull, is yet free, excepting only the spur already mentioned, which includes Jersey City and runs north as far as Hackensack."

Although the insect has existed in the State for ten years the damage sustained is comparatively slight and local. "Practically none save peach trees have been actually killed," and "no single fruit grower has sustained serious injury."

So far as examinations made in 1897 can show there are but two large nurseries within the State having more than a local trade that have traces of the scale, and these are slight. Four, possibly five, nurseries in Burlington, Monmouth, and Atlantic counties with a local trade are infected. The purchaser should demand a guaranty from the grower rather than a certificate.

There can be no doubt as to the destruction to certain fruits, peaches being especially sensitive and following them thin-leaved varieties of plums. Other varieties, and large trees as compared with young trees, suffer less. The latter fact is owing partly to the scale not being able to develop well in the shade, a statement that is particularly true in moist weather.

In conclusion, past experience proves that a single application of any remedy should not be relied upon, but that after a thorough treatment of the infested trees, continual vigilance must be exercised and all omissions promptly attended to with secondary treatment. Little hope is to be had from natural checks save the effect of moist weather, cold, and shade. The California ladybirds introduced have not survived,

and the native parasitic and predaceous forms though increasing in number very rapidly, have thus far not produced any noticeable beneficial effect. *Sphærostilbe coccophila* has been introduced into two orchards, in one of which it has become well establishd and may be of service. *Adalia bipunctata* is noted as having been found attacking the larvæ.

Of the various remedies of which the author treats, whale-oil soap (at the usual rate of 2 lbs. to 1 gal. of water or in summer half that strength) and kerosene (applying the finest spray and making the thinnest possible coating and then only when the weather favors evaporation and on dry trees) are especially noted. On some trees the buds are injured by strong solutions of soap, but this effect may be obviated by spraying just before the trees leave out. The application of kerosene, preferably of 150°, though that of 110° has been successfully applied, should be preceded by trimming the trees at least a month before spraying. Summarizing his methods of treatment, he states that badly infested trees should be treated in the winter with either soap or kerosene, according to circumstances, and this followed by one or more summer treatments. Of the two methods, since it is safer, whale-oil soap should be used where it may be effective. "The scales are not hard to kill; the only difficulty is to get all of them."

Relative to certificates and legislation, the author plainly shows that he believes the former more or less worthless and part of an impracticable method. The practice of giving certificates to nurseries has been discontinued for the reason that the certificates are apt to be misused and because of the impossibility of certifying the absolute freedom from the scale. Little sympathy is evinced with the effort to control insects by law, though the author seems to favor a law providing for the destruction of plant pests and for a salaried official whose duties shall be to locate the scale.

The periodical cicada in West Virginia, A. D. HOPKINS (*West Virginia Sta. Bul. 50, pp. 46, pls. 4, figs. 23, map 1*).—More than two-thirds of the entire territory of the State, as learned through circular postal cards sent to all parts of the State, is infested with Brood XV of this insect, which was first recorded for the State May 15, 1795, and has been recorded regularly at 17-year intervals ever since. A large part of the southern portion and some of the eastern portion of the State are uninfested with this brood. Nowhere does the insect seem to occur above an elevation of 3,000 ft.

Where the broods occur the loss occasioned by the oviposition of eggs is very considerable, not only greatly disfiguring twigs but causing them to die and break off. Very often the punctures of the twigs, especially in old and more or less unthrifty trees, never heal over, owing largely to their being immediately attacked by the woolly aphis. Similar injury is also shown to be due to similar wounds produced by the tree cricket, which are kept from healing by the same aphid.

On the northern border of the infested district the adults appear nearly two weeks later than those along the southern border. As between the lowest and the highest altitudes there seems to be a difference of appearance of about four weeks, which corresponds with the difference in average summer temperature to be found between the localities. Between the northern and southern boundaries of the region this difference is 3.5°, between the lower and higher altitude 10°. Each degree of difference in the mean summer temperature appears to make about three and one-half days of difference in the time of the first general appearance of the cicada. Whether this seeming rule will also apply to other broods remains to be determined. The character of the weather at the time of emergence is important. If it be cold the insects become chilled, crawl slowly, and become an easy prey to birds, poultry, and other predatory enemies.

The author notes finding an isolated specimen in May, 1895, which, although appearing two years earlier than the normal time, he feels certain belongs to Brood XV. None were seen or heard during the spring of the next year, but during the fall of 1896 several specimens were heard. This appears to be the second record of an occurrence of this cicada in the fall of the year.

At Morgantown, West Virginia, the first cicadas were heard May 27 and 30. Copulation commenced about June 9, oviposition about the 13th. The leaves and wounded twigs began to wilt four days later. The insects began disappearing the last week of June and none were heard after July 4. Eggs on twigs began hatching August 20 and all the young during the following week seemed to have emerged.

The eight broods and nine swarms occurring in the State are XVII (1898), XX (1900), XXI (1901), XXII (1902), V (1905), VIII (1906), XI (1910), and XV (1914). It will be noted that they occur in periods of 2, 1, 1, 3, 1, 4, and 4 years. The author gives brief notes, historical and otherwise, on each of these broods and swarms, and then notes the sections of the State where several broods overlap. Of the eight broods in point of numbers XXI, XXII, V, VIII, and XV are most to be feared, the last being the largest swarm.

Among natural enemies mentioned, aside from numerous predatory and parasitic insects not definitely named and a contagious disease often of an epidemic nature, are English sparrows, hogs, poultry, and squirrels.

Some common injurious insects of western Nevada, F. H. HILLMAN (*Nevada Sta. Bul. 36, pp. IX+39*).—A popular descriptive list of 39 insects, including a brief key for their identification. The habits of each are brought out and in most cases the most practical remedies. Some of the more important points are the probable occurrence of two distinct broods of *Euvanessa antiopa* in Nevada, the first about June, the second in August or September. It has fed only on the elm and willow. *Vanessa cardui* does not feed on hollyhock in that region.

The apple aphis (*Aphis mali*) seems to confine its attack mostly to young trees, and is attacked by a disease probably of bacterial nature that destroys large numbers during the latter part of the summer. The bodies shrivel up, turning to a dark-brown color, and remain on the leaves. The woolly aphis (*Schizoneura lanigera*) is thoroughly established and is especially favored by the character of the Nevada climate. In many orchards uninfected trees are the exception. *Mytilaspis pomorum* has not yet been found in the State on fruits, but has been taken from the Lombardy poplar in Carson City. Other insects treated are as follows: Flat-headed apple-tree borer (*Chrysobothris femorata*), pear and cherry slug (*Selandria cerasi*), imported cabbage butterfly (*Pieris rapæ*), mourning-cloak butterfly (*Euvanessa antiopa*), hollyhock butterfly (*Vanessa caryæ*), hop-vine butterfly (*Grapta satyrus*), tomato worm (*Phlegethontius celeus*), poplar hawk moth (*Marumba modesta*), locust-tree carpenter moth (*Prionoxystus robiniæ*), codling moth (*Carpocapsa pomonella*), ash-gray pinion (*Lithophane antennata*), currant-stem borers (*Sesia tipuliformis*, *Chrysobothris femorata*), cabbage plusia (*Plusia brassicæ*), corn-ear worm (*Heliothis armiger*), zebra caterpillar (*Mamestra picta*), cutworms, diamond-back moth (*Plutella cruciferarum*), snowy tree cricket (*Œcanthus niveus*), plant lice (*Aphis* spp.), apple-leaf louse (*A. mali*), woolly aphis (*Schizoneura lanigera*), cabbage louse (*A. brassicæ*), plum-leaf louse (*A. prunifolii*), rose-plant louse (*Aphis* sp. ?), currant-leaf louse (*A. ribis*), elm-leaf louse (*Aphis* sp.?), cottonwood-leaf louse (*Aphis* sp.?), poplar-leaf gall louse (*Pemphigus* sp.?), willow-stem louse (*Lachnus* sp.?), San José scale (*Aspidiotus perniciosus*), English-walnut scale (*Aspidiotus juglans-regiæ*), oyster-shell bark louse (*Mytilaspis pomorum*), *Lecanium ribis*, cottony maple scale (*Pulvinaria innumerabilis*), imported elm-bark louse (*Gossyparia ulmi*), rose-leaf hopper (*Typhlocyba rosæ*), buffalo tree hopper (*Ceresa bubalus*), red spider (*Tetranychus telarius*).

Insect injuries to Ontario crops in 1896, J. FLETCHER (*Rpt. Ontario Ent. Soc. 1896, pp. 58–69, figs. 15*).—Cereals were attacked by the wheat-stem maggot (*Meromyza americana*), American frit fly (*Oscinis variabilis*), Hessian fly (*Cecidomyia destructor*), wheat midge (*Diplosis tritici*), grain aphis (*Siphonophora avenæ*), and army worm (*Leucania unipuncta*).

Fodder crops were attacked by three common species of grasshoppers—the red-legged locust, two-striped locust, and the lesser migratory locust. In some cases they were reported to have disappeared suddenly. This was doubtless due to the increase of their natural enemies—*Empusa grylli*, tachina flies, and locust mites (*Trombidium locustarum*), which seem to be the most efficient workers in keeping down the numbers of grasshoppers. This mite is discussed somewhat at length. Another parasite of grasshoppers noted is the hair snake or hair worm. Other insects noted are gray blister beetle (*Macrobasis unicolor*), clover-root borer (*Hylesinus trifolii*), clover-seed

midge (*Cecidomyia leguminicola*), white grub (*Lachnosterna*, sp.), clover cutworm (*Mamestra trifolii*), zebra caterpillar (*Mamestra picta*), two hymenopterous insects (*Trichogramma pretiosa* and *Telonomnus* sp.), red-backed cutworm (*Carneades ochrogaster*), black army worm (*Noctua fennica*), striped cucumber beetle (*Diabrotica vittata*), squash bug (*Anasa tristis*), apple curculio (*Anthonomus quadrigibbus*), apple maggot (*Trypeta pomonella*), cigar-case bearer (*Coleophora fletcherella*), pear slug (*Selandria cerasi*), phylloxera (*Phylloxera vastatrix*), grape thrip (*Erythroneura vitis*), strawberry-leaf roller (*Phoxopteris comptana*), red spider (*Tetranychus* sp.), and black peach aphis (*Aphis persicæ-niger*).

Root crops were attacked by the clover cutworm (*Mamestra trifolii*), zebra caterpillar (*Mamestra picta*), and white grub (*Lacnosterna* sp.). As parasites on the zebra caterpillar *Trichogramma pretiosa* and a new species of Telonomnus are mentioned.

Vegetables were attacked by the red-backed cutworm (*Carneades ochrogaster*), striped cucumber beetle (*Diabrotica vittata*), and squash bug (*Anasa tristis*); fruits, by the apple curculio (*Anthonomus quadrigibbus*), apple maggot (*Trypeta pomonella*), (which has not hitherto been known to attack fruit trees in Ontario), cigar-case bearer (*Coleophora fletcherella*), pear slug (*Selandria cerasi*), phylloxera (*Phylloxera vastatrix*), grape thrip (*Erythroneura vitis*), strawberry-leaf roller (*Phoxopteris comptana*) (the two broods of which did considerable injury around Picton in Prince Edward County), a red spider (*Tetranychus* sp.), and black peach aphis (*Aphis persicæ-niger*).

Injurious insects, etc. (*Jour. Bd. Agr.* [*London*], *4* (*1898*), *4*, *pp. 468–480*, *figs. 6*).—The stem eelworm (*Tylenchus devastatrix*), orchid beetle (*Xyleborus perforans*), pine aphis (*Lachnus pini*), and fruit-tree beetle (*Scolytus rugulosus*) are discussed. Injuries caused by the first appear to be extending, wheat, oats, hops, clover, and onions being the principal objects of attack, although attacks on the first are not very common. In the hops other species (*Heterodera schactii*) are also found. Other plants noted as attacked are rye, beans, the grasses (*Anthoxanthum odoratum*, *Holcus lanatus*, and *Poa annua*), and various weeds, viz, daisy, shepherd's purse, spurry, buttercup, cornflower, sow thistle, etc. The worms which are briefly described are exceedingly hardy, larvæ having been revivified after being dried for two and one-half years. This power of enduring drought greatly increases the chances of distribution. Cold nearly suspends animation. A scarcity of food causes the larvæ to migrate upward to the surface where life is suspended in the dry soil.

The usual remedy of deep plowing, burning of refuse, allowing the land to lie fallow, and the use of fertilizers are recommended, the mixture thought best being 3 cwt. sulphate of potash and 1 cwt. sulphate of ammonia, although 1 cwt. sulphate of iron, 1 cwt. sulphate of potash, and 1 cwt. sulphate of ammonia was nearly as good. For imported clover 4 cwt. dissolved bones and 2 cwt. sulphate potash per acre was

good. Another mixture was composed of 4 cwt. of kainit, 2 cwt. sulphate iron, and 3 cwt. superphosphate. For oats 5 cwt. kainit, $1\frac{1}{2}$ cwt. sulphate of ammonia, and 1 cwt. sulphate of iron, also 2 cwt. sulphate of potash, 2 cwt. sulphate of iron, 3 cwt. nitrate of soda, and 1 cwt. sulphate of potash are said to have given good results. For onions the best mixture is thought to be sulphate of potash, sulphate of iron, and nitrate of soda, mixed at the rate of 2 cwt. each per acre.

Natural history of the genus Chrysopa, Leach, M. LURIE (*Abs. in Zool. Centbl., 5 (1898), No. 10, pp. 335, 336*).—The original is in Russian. The author arrives at the conclusion that the laying of eggs by the lace-winged fly at the end of a long stalk is for protection rather than for accelerating the development of the egg. The period of the egg state is constant for each species. In the larva of *Chrysopa ventralis* a dorsal shield serves as a protection against parasitic Hymenoptera. The larvæ of *C. septempunctata* molts on the fourth and seventh day after leaving the egg, and probably also a third time. When the time for pupation is near the larva first spins a sort of cover with a thread from an anal gland, then lies on its back and spins a web beneath it. When the cocoon has become thick the larva rolls itself up and ceases spinning.

The substance used in the formation of the cocoon, the author states, is derived from the upper fringe of Malpighian vessels. The cell nuclei of these undergo changes during the process of secreting. Formerly round, they become oblong, and at the completion of the process they assume a peculiar branched form. In *C. vulgaris* there is a double generation. There is in the vicinity of Warsaw, however, but one. The pupal state lasts six months, the larval over five, the egg state several days, and the number of eggs reaches sixty.

Besides the general biology the author also studied the anatomy of the insect. The mandibles recall those of the ant-lion larva.

How flowers attract insects, P. KNUTH (*Bot. Centbl., 74 (1898), No. 2, pp. 39-46; abs. in Zool. Centbl., 5 (1898), No. 10, pp. 331, 332*).—The author considers Plateau's conclusions (E. S. R., 9, p. 158) on this subject as imperfect. The odor of flowers is thought to attract until the insect is within 1 or 2 meters, when sight is thought to be the chief guide.

Catalogue of the Odonata of Ohio, D. S. KELLICOTT (*Jour. Cincinnati Soc. Nat. Hist., 19 (1897), No. 2, pp. 66-71*).—Thirteen species are noted here.

Orthopterological notes. I, On the development of the wings in the genus Nemobius; II, Parthenogenesis and parasitism in Bacillus gallicus, J. DOMINIQUE (*Bul. Soc. Sci. Nat. Ouest France, 7 (1897), pp. 265-271; abs. in Zool. Centbl., 5 (1898), No. 7, p. 230*).—The eggs of the second generation of *Bacillus gallicus* in the cases investigated developed but few larvæ and all of these turned out to be females.

Three new species of Chrysopidæ, N. BANKS (*Proc. Ent. Soc. Washington, 4 (1897), No. 2, pp. 173-175*).—*Chrysopa sabulosa, C. fraterna*, and *Leucochrysa americana*. The first and second from Fort Collins, Colorado, and the third from Auburn, Alabama.

The species of Pepsis inhabiting America north of Mexico, W. J. FOX (*Proc. Ent. Soc. Washington, 4 (1897), No. 2, pp. 140-148*).—Four new species, *Pepsis circularis, P. lucasii, P. inermis*, and *P. boguei* are described.

Entomology of the oak, A. T. GILLANDERS (*Trans. Manchester Micros. Soc., 1897, pp. 78–88; abs. in Jour. Roy. Micros. Soc.* [*London*], *1898, No. 3, p. 74*).

A preliminary review of the North American Delphacidæ, E. P. VAN DUZEE (*Buffalo Soc. Nat. Sci. Bul., 5, No. 5, pp. 225–261*).—A taxonomic paper mentioning old and describing new species.

Studies on insect larvæ. I, On the knowledge of Phalacrocera replicata, S. BENGTSSON (*Lands Universitats Årsskr., 33* (*1897*), *pp. 118, pls. 4; abs. in Zool. Centbl., 5* (*1898*), *No. 8, pp. 268–272*).—The entire development of this water larva runs through the course of a year. The egg state lasts from 8 to 12 days, the pupal period 7 to 8. There have been 8 moltings determined with certainty and very probably there are 9, if not 10. The old skin always bursts longitudinally along the back. Though the larva has a true head, it forms a link between the well-marked head of the encephalic dipteran larvæ with the "jaw cap" of Tipulid and other dipteran larvæ. Three thoracic and nine abdominal segments are to be distinguished.

Hymenoptera, Neuroptera, Pseudoneuroptera, Orthoptera, and Rhingota of Italy, A. GRIFFINI (*Imenotteri, Neurotteri, Pseudoneurotteri, Orthotteri, e Rincoti Italiani. Milan: U. Hoepli, 1897, pp. XV + 677, figs. 223*).—In treating of each genus an example is figured and treated morphobiologically. For a preliminary study of insects the volumes are very useful, although they can not give a complete scientific conception of Italian fauna, and since the authorities for the species are not mentioned the latter can not be placed with certainty.

On two Lepidoptera injurious to sugar cane introduced into the Mascareignes Islands, E. BORDAGE (*Compt. Rend. Acad. Sci. Paris, 125* (*1897*), *No. 25, pp. 1109–1112*).—The history of the introduction and synonymy of *Diatræa striatalis* and *Sesamia nonagrioides*.

Considerations on the study of melliferous plants, A. SONSIEDSKY (*Rev. Internat. Apicult., 20* (*1898*), *No. 4, pp. 68–71*).—The meagerness of any popular literature on the subject of melliferous plants is noted, yet the subject is well worth study. A well-known Russian apiculturist, Zoubareff, in a work on apiculture states that one can not give any one plant absolute preference, for the same plant on different soil and under different conditions of climate varies in the quantity and quality of nectar yielded. Plants considered to be of secondary value in one country or locality in others may take first rank. *Melissa officinalis* is indigenous to a moist climate and loses its melliferous qualities in a dry one.

Bee keeping and its regulation in the Middle Ages and in recent times, M. WAGNER (*Inaug. Diss., Munich, 1897, pp. 89, pl. 1, maps 3*).—This deals with bee keeping in its historical and legal aspects, going back to the time of Charlemagne.

Something new relative to the development of gadfly larvæ of cattle, SCHNEIDEMÜHL (*Centbl. Bakt. u. Par., 1. Abt., 22* (*1898*), *No. 24–25, pp. 752–760*).—Besides making historical mention of several Œstridæ, the pathological significance of *Œstris ovis* is noted and more at length the life history of *Hypoderma bovis*. Contrary to the belief hitherto current, the larvæ of the latter insect passes the greater portion of its larval existence inside the animal. The eggs enter the alimentary canal partly with the fodder and partly from licking the skin.

Notes on the season of 1896, J. A. MOFFAT (*Rpt. Ontario Ent. Soc., 1896, pp. 76–79, figs. 2*).—The climatic conditions in the southern portion of Ontario are noted as having been very diverse within short distances, but the Colorado beetle and the imported cabbage butterfly seem to flourish under all conditions. *Hadena arctica*, which were very abundant in 1895, were exceptionally rare this year. The army worm (*Leucania unipuncta*) was very destructive near Hamilton, Ontario. A Harpalus was found preying upon it. The lime-tree winter moth (*Hybernia tiliaria*) was very abundant around London, Ontario, in the early part of October. Other insects noted are *Papilio marcellus*, *P. philenor*, *P. cresphontes*, *Erebus odora*, the Carolina sphinx (*Macrosila carolina*), *Cisthene unifascia*, *Aspila virescens*, and *Hyphantria cunea*, the last being very prevalent.

Report on injurious insects in Finland, 1895 and 1896, E. REUTER (*Landtbr. Styr. Meddel., 1897, No. 21, pp. 53*).

Injurious and useful insects of Java, I, J. C. KONIGSBERGER (*Meded. S'Lands Plantentuin, 22 (1898), p. 53*).

Some injurious insects, G. C. DAVIS (*Michigan Sta. Rpt. 1896, pp. 375–401, figs. 21*).—A reprint of Bulletin 132 of the station (E. S. R., 8, p. 241).

Pests of house and ornamental plants, G. C. DAVIS (*Michigan Sta. Spec. Bul 2, pp. 45, figs. 34*).—This is a popular bulletin giving notes as to insecticides and on the following insects, with suggestions as to treatment: Red spider (*Tetranychus telarius*), myriapods, isopods, slugs and snails, eel worms (*Heterodera radicola*), thrips (*Coleothrips trifasciata*), yellow-lined plant bug (*Pœcilocapsus lineatus*), tarnished plant bug (*Lygus pratensis*), hollyhock bug (*Orthotylus delicatus*), chrysanthemum net wings (*Corythuca ciliata* and *C. gossypi*), water-lily leaf hopper (*Megamelus davisi*), plant lice, aleyrodes, mealy bugs, scale insects, cutworms, rosebud moths, white grubs, wireworms, Fuller's rose beetle (*Aramigus fulleri*), rose slugs (*Monostegia rosæ*), and ants.

Some beetles occurring upon beech, W. H. HARRINGTON (*Rpt. Ontario Ent. Soc., 1896, pp. 69–75, figs. 7*).—The following insects are mentioned, most of which are briefly described and some of which were bred: *Hyperetis nyssaria*, pretty little casemaker (*Incurvaria acerifoliella*), large horntail (*Tremex columba*), *Trogosita corticalis, Grynocharis 4-lineata, Corymbites cruciatus, Dicerca divaricata, Chrysobothris femorata, C. sexsignata, Agrilus bilineatus, A. interruptus, Brachys æruginosa, B. ærosa, Thanoclerus sanguineus, Eucrada humeralis, Ptilinus ruficornis, Platycerus quercus, P. depressus, Ceruchus piceus, Dichelonycha elongata, Osmoderma scabra, Parandra brunnea, Smodicum cucujiforme, Dryobius sexfasciata, Xylotrechus quadrimaculatus, Cyrtophorus verrucosus, Centrodera decolorara, Toxotus schaumii, Anthophilax attenuatus, Leptura subhamata, Goes pulverulentus, Acanthoderes quadrigibbus, Leptostylus macula, Hoplosia nubila, Pelecotoma flavipes, Pandeletegus hilaris, Ithycerus noveboracensis, Cryptorhynchus bisignatus, Acoptus suturalis, Phlœophagus apionoides, P. minor, Stenoscelis brevis, Monarthrum fasciatum,* and *Xyleborus obesus.*

Contributions to the biology of some bark beetles of Austria and bordering countries, J. KNOTEK (*Oesterr. Vierteljahrsschr. für Forstwesen., 1897, No. 2, pp. 136–161, figs. 6; abs. in Zool. Centbl., 5 (1898), No. 7, pp. 236, 237*).—In the first publication the author enumerates 57 species, giving notes on local distribution and on food plants. As new species *Hylesinus henscheli* and *Scolytus aceris* are mentioned, the first of which is similar to *H. crenatus*. The latter is closely related to *S. intricatus* of Ratzeberg, which feeds on several maples. The appearance of its work recalls that of *S. geoffroyi* of Goetze. Several observations are also made on the two little known species *Phlocosinus bicolor* of Brull (*Aubei* of Perris), and *Scolytus lævis* of Chapuis.

In the second paper additions are made to the list just noted.

The bark beetles of Bosnia and Herzegovina, J. KNOTEK (*Wissen Mittheil aus Bosnien u. d. Hercegovina, 2 (1894), pp. 7, pls. 2; abs. in Zool. Centbl., 5 (1898), No. 7, pp. 236, 237*).

Lepidopterous pests of the meadow and the lawn, T. W. FYLES (*Rpt. Ontario Ent. Soc., 1896, pp. 97–104, figs. 5*).—This is mostly a descriptive list with notes on Satyrinæ, Hesperidæ, Ctenuchidæ, Arctiidæ, Noctuidæ, and Crambidæ affecting Gramineæ. A table for the identification of a species of Crambus is given.

The principal insect enemies of the grape, C. L. MARLATT (*U. S. Dept. Agr., Farmers' Bul. 70, pp. 23, figs. 12*).—This is a reprint from the Yearbook of this Department for 1895 (E. S. R., 9, p. 803).

The butterflies of the eastern provinces of Canada, C. J. S. BETHUNE (*Rpt. Ontario Ent. Soc., 1896, pp. 106–110, figs. 9*).—This is a list of 114 butterflies with notes as to the locality where taken and their relative abundance. *Grapta interrogationis*, usually rare in the Province of Quebec, was found in great abundance feeding on

elm in the vicinity of Montreal. The variety *G. interrogationis umbrosa* was abundant at Port Hope in May and June and *G. interrogationis fabricii* was taken July 29 and as late as November 10, 1896. *Argynnis atlantis* is noted as having extended its range and is now found at Orillia. *Colias cæsonia* appeared suddenly in very considerable numbers in several localities during the summer of 1896.

Contributions to the biology and morphology of the Aphidæ. I, On the biology of some species of Aphides, A. MORDVILKO (*Horæ Soc. Ent. Ross. [St. Petersburg], 31, pp. 253–313, ill.; abs. in Zool. Centbl., 5 (1898), No. 7, pp. 231–234*).—This work comprises a number of recent observations on the biology of several aphides and forms a continuation of an earlier communication. The morphological peculiarities and the biological phenomena are considered in connection with surrounding conditions of life.

Germany's exclusion of American fruits, J. B. SMITH (*North American Review, 66 (1898), No. 4, pp. 460–465*).—The reason for the exclusion of American fruits by the German Government is explained as due to a misunderstanding of the nature and means of dispersal possessed by the San José scale. So far as known, the insect has never spread from fruit to tree. It can only crawl before it becomes fixed to its host plant, but if infested fruit should be brought sufficiently close to a plant there is no doubt that the scale could be spread in this way.

The San José scale, L. R. TAFT (*Michigan Sta. Rpt. 1896, pp. 124, 125*).—Briefly discusses the scale and its treatment, and notes the scales that may be mistaken for it.

The black peach aphis, L. R. TAFT (*Michigan Sta. Rpt. 1896, pp. 125–127*).—Numerous complaints are noted. The insect was particularly injurious to young trees, and was distributed by ants and other insects. Tobacco water, salt, nitrate of soda, kerosene emulsion, bisulphid of carbon, and wood ashes are noted as remedies.

The box-elder plant bug, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Circ. 28, 2. ser., pp. 3, fig. 1*).—The general appearance, method of work, distribution, habits, and remedies against *Leptocoris trivittatus* are very briefly discussed.

Mites injurious to plants, VON SCHLECHTENDAL (*Ztschr. Naturw. [Jena], 70 (1898), No. 3, pp. 228, 229*).

The pests and blights of the tea plant, G. WATT (*Calcutta: Supt. Govt. Printing, India, 1898, pp. III+467+XVII, figs. 11*).—A report of investigations made in Assam and Kangra. The culture of the tea plant is discussed with special reference to diseases and insect pests.

The spruce gall louse, W. BRODIE (*Ontario Dept. Agr. Spec. Bul., May, 1898, pp. 2, pl. 1*).—A popular circular on *Chermes abietis*.

Report of the consulting entomologist, G. C. DAVIS (*Michigan Sta. Rpt. 1896, pp. 135–138*).—*Lygus pratensis*, mushroom insects (*Tyroglyphus phylloxera*, *Sciaria vulgaris*, *Aphodius granarius*, and *Ips fasciatus*), little red cherry beetle (*Adimonia caricollis*), false chinch bug (*Nyssius angustatus*), grasshoppers, and the Hessian fly (*Cecidomyia destructor*) are mentioned. Ten or more common varieties of wheat at the college farm were severely injured by the last insect.

Spraying—why and how, L. R. TAFT (*Michigan Sta. Spec. Bul. 4, pp. 13–19, fig. 1*).—A popular discussion of the subject, noting formulas for insecticides, fungicides, and apparatus.

Instructions in spraying (*Ontario Dept. Agr. Spec. Bul., Mar., 1898, pp. 16, figs. 13*).—Directions are given for the preparation of fungicides and insecticides and the treatment of different host plants for the prevention of attacks of injurious fungi and insects.

White arsenic as a substitute for Paris green, L. R. TAFT (*Michigan Sta. Rpt. 1896, pp. 119, 120*).—Arsenic is found to be much less expensive than Paris green and fully as efficient if not more so. One pound is placed in 2 gal. water with an equal weight of freshly slacked lime and boiled for 30 to 40 minutes. The resulting insoluble calcium arsenate is sufficient for 400 gal. water. At this strength it can be employed on all kinds of fruit along with Bordeaux mixture. It costs about one-fifth as much as Paris green.

On some parasites of Coccidæ, with descriptions of two new genera of Aphelininæ, L. O. HOWARD (*Proc. Ent. Soc. Washington, 4 (1898), No. 2, pp. 133–138, figs. 3*).—Besides describing two new species, the representatives of two new genera, namely, *Archenomus bicolor* and *Azotus marshali*, notes on distribution are given. Prior to 1891 *Aspidiotiphagus citrinus* was unknown. In this country since then it has been taken from 18 species of scale insects and from many localities in the United States, from Grenada, British West Indies; Portici, Italy; Punduloya, Kandy, Ceylon; Hongkong and Amoy, China; Tamsui, Formosa; Yokohama, Japan; Newlands, Cape Colony; Adelaide, South Australia; and Honolulu, Hawaii. A similar wide distribution has also been found for *Prospalta aurantii, Aphelinus fuscipennis, A. mytilaspidis*, and *A. diaspidis*. *Arrhenophagus chionaspidis* has also an almost universal distribution. As a new locality for *A. diaspidis*, San Luis, Mexico, is noted, and for *A. fuscipennis*, Natal.

A new Swedish egg parasite, C. AURIVILLIUS (*Ent. Tidskr., 18 (1897); abs. in Zool. Centbl., 5 (1898), No. 9, p. 295*).—The author describes and figures a pteromalid of the subfamily Trichogrammatinæ, for which he erects the genus Oophthora. The form seems to be closely related to Trichogramma of Westwood. It differs from that form in its longer, nearly cylindrical, abdomen. The author thinks that *Trichogramma pretiosa* and *T. minutæ* of Riley may possibly be properly considered as belonging to the new genus. To the species he gives the name Osenblidis. The specimens emerge from the eggs of *Semblis lutaria*. The male appears to be dimorphic. Some appear without wings, others with wings. The latter closely resemble the female.

Notes on parasitic Hymenoptera, with descriptions of some new species, G. DIMMOCK and W. H. ASHMEAD (*Proc. Ent. Soc. Washington, 4 (1898), No. 2, pp. 148–171*).—Brief notes by Dimmock on 70 species, and a description by Ashmead of 29 new species belonging to the genera as follows (the figures denoting the number of species of the genus): Telonomus, Allotria, Encyrtus, Habrocytus, Elachistus, Cratotechus, Eulophus, Apanteles (6), Protopanteles (2), Microplitis, Aphidius, Hypotherentes, Ischnoscopus, Mesochorus, Neoeryma, Sychnoportus, Phæogenes, Acrobela, and Asphragis.

Parasitic worms on cultivated plants, E. HENNING (*Landtmannen, 9 (1898), No. 19, pp. 299–303, ill.*).

Development of Platygaster, N. KULAGIN (*Ztschr. Wiss. Zool., 63 (1897), pp. 195–235, pls. 2; abs. in Jour. Roy. Micros. Soc. [London], 1898, No. 3, p. 73*).—This parasite of Cecidomyia, it is learned, occurs in a large number of dipterous, hemipterous, and hymenopterous larvæ. The larva of Platygaster lives on the fat body of the host and pupates at the same time with it. The occurrence of one parasite in the same host is not usually fatal; the occurrence of two is.

Repressive measures against enemies of field crops, B. FRANK (*Kampfbuch gegen die Schädlinge unserer Feldfrüchte. Berlin: Parey, 1897, pp. 308, pls. 20, figs. 46; abs. in Zool. Centbl., 5 (1898), No. 5, p. 157*).—This work will doubtless be of considerable use to many zoologists. It is written in a popular style, showing how to recognize the animal and vegetable enemies of vegetables; treats of life histories, habits, etc. The colored plates represent the eggs, larvæ, and the character of ravages. The book is divided into five parts, treating of the injuries to conifers, leguminous plants, potatoes, corn, and beets.

FOODS—ANIMAL PRODUCTION.

Food preservatives, H. LEFFMANN (*Pennsylvania Dept. Agr. Rpt. 1897, I, pp. 535–518*).—A number of food preservatives are described. The effect upon the digestibility of starch of the following substances was tested: Saccharin, beta-naphthol, formalin, artificial benzoic acid,

natural benzoic acid, artificial sodium benzoate, sodium benzoate, boroglycid, sodium carbonate, salicylic acid, citric acid, boric acid and borax (alone and together), tartaric acid, sodium fluorid, and sodium silico-fluorid. The digestive ferments employed were malt diastase, taka-diastase, pancreatic extract, peptenzym, and carase. A few qualitative experiments on the effect of preservatives on peptic digestion were made but are not reported in detail.

The general conclusions follow:

"Salicylic acid in all its forms, i. e., natural, crude commercial, and refined commercial, is distinctly antagonistic to most enzyms, especially those that convert starch. There seems to be no reason to believe that the natural form of the acid will be less objectionable than the artificial in this respect, even if its price does not exclude its use.

"Sodium benzoate is without appreciable interfering action, and as its preservative action is undoubted and its disagreeable taste will prevent its liberal use in any food article, it seems to be well adapted for general use.

"Boric acid and borax show but little interfering action with either starch or proteid digestion. Boroglycid seems also to possess but little interfering action.

"Beta-naphthol interferes with the action of malt-diastase, but not seriously with taka-diastase or pancreatic extract. It interferes very decidedly with peptic and pancreatic digestion of proteids.

"Sodium fluorid has but little interfering action with starch transformations, but sodium silico-fluorid interferes decidedly with pancreatic extract.

"Sodium acid sulphite is without retarding effect.

"Salicylic acid does not interfere seriously with proteid digestion."

Analyses of feeding stuffs, E. F. LADD (*North Dakota Sta. Bul. 32, p. 277*).—Analyses are reported of corn silage, prairie hay, Hungarian hay, and fodder from corn planted at different distances. The results of the latter analyses are as follows:

Composition of fodder from corn planted at different distances.

	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
In drills 3½ by 2 ft	9.38	2.00	63.85	19.84	4.93
In drills 6 in. apart	8.14	2.61	57.66	23.22	8.37
In rows 3½ by 16 in	8.20	2.48	63.39	20.96	4.97
In drills 30 in. in drill	8.67	2.98	58.49	23.98	5.88

In the author's opinion the best fodder was obtained when the plants had room for full development.

Nutrition investigations at the University of Tennessee in 1896 and 1897, C. E. WAIT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 53, pp. 46*).—The investigations include studies of the composition of a side of Tennessee beef, a side of Tennessee mutton, and the meat of chickens; two dietary studies with mechanics' families, and two with students' clubs; and a number of experiments with man on the digestibility of combinations of two food materials and of a mixed diet. In connection with the latter experiments the balance of income and outgo of nitrogen was usually determined also.

The studies of the composition of meat and the dietary studies were similar to those carried on previously under the auspices of the Department of Agriculture at the University of Tennessee and other institutions. The results of the dietary studies are briefly shown in the following table:

Results of dietary studies—cost and composition of food eaten per man per day.

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Mechanic's family	11	97	206	426	4,060
Do	17	95	127	305	2,820
Students' club	17	123	142	433	3,595
Do	14	66	155	451	3,560

The digestion experiments were made with healthy subjects. Two, and sometimes three or four, subjects received the same kinds of food, the quantities varying to suit the individuals. The food, urine, and feces were analyzed according to the usual methods. The results of the experiments are summarized in the following table:

Summary of the twenty-one digestion experiments, showing coefficients of digestibility found.

Experiment No.	Subject.	Kind of food and weights per day (in grams).	Total organic matter.	Protein.	Fat.	Carbohydrates.	Ash.	Available energy.
			Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
16	A	Bread 663, milk 2,532	98.9	97.5	98.5	99.3	85.1	93.7
17	B	Bread 490, milk 2,402	98.2	97.5	97.9	98.5	78.0	92.4
18	A	Bread 630, milk 2,525	97.6	95.7	97.6	98.1	68.1	91.9
19	B	Bread 430, milk 2,678	98.0	97.2	97.7	98.3	75.6	92.1
		Average	98.2	97.0	97.9	98.6	76.7	92.3
20	A	Bread 315, beef 758	96.0	95.0	96.3	96.9	78.3	85.8
21	B	Bread 200, beef 333	95.1	93.0	92.0	97.4	72.7	85.2
		Average	95.6	94.0	94.2	97.2	75.5	85.5
22	A	Bread 365, milk 1,941, eggs 492	96.1	94.2	94.8	97.7	62.2	89.3
23	B	Bread 269, milk 1,897, eggs 390	95.6	95.0	93.8	96.8	60.9	87.9
24	C	Bread 279, milk 2,157, eggs 517	95.1	93.4	95.8	95.7	68.1	87.9
25	D	Bread 354, milk 942, eggs 402	96.6	95.8	94.1	97.8	72.4	89.2
		Average	95.9	94.6	94.6	97.0	65.9	88.6
26	A	Bread 238, milk 2,550, oatmeal 120, corned beef 100, bananas 482, sugar 50	96.4	92.8	96.0	97.6	72.6	90.2
27	D	Bread 354, milk 638, oatmeal 78, corned beef 106, bananas 44, sugar 38, molasses 75	96.5	92.1	92.7	98.2	74.1	90.8
28	B	Bread 131, milk 2,609, oatmeal 65, corned beef 75, bananas 209, molasses 125	96.0	93.5	95.7	97.0	62.0	90.1
29	E	Bread 298, milk 2,100, oatmeal 119, sugar 59	95.8	93.1	95.3	96.8	50.0	90.0
30	F	Bread 353, milk 2,100, oatmeal 153, sugar 56	95.4	91.1	90.4	97.7	59.5	89.5
31	A	Bread 280, milk 2,190, wheatlet 175, sugar 38	96.3	92.2	95.7	97.6	54.8	91.0
32	B	Bread 187, milk 2,166, wheatlet 61, sugar 56	96.6	94.6	94.9	97.8	58.3	91.0
33	F	Bread 303, milk 2,350, corned beef 211, canned corn 760	92.2	88.3	89.8	94.8	61.2	85.9
34	A	Bread 382, milk 2,378, boiled ham 125, canned corn 425	95.7	92.4	96.1	96.7	62.9	90.3
35	E	Bread 298, milk 2,350, corned beef 176, potato chips 119	96.4	95.0	97.7	96.3	73.1	90.5
36	B	Bread 205, milk 2,325, boiled ham 113, potato chips 90	95.4	94.0	93.8	97.1	65.0	89.6
		Average 11 with mixed diet	95.7	92.6	94.4	97.1	63.0	89.9

As previously stated, in a number of the experiments the urine and feces were analyzed and the balance of income and outgo of nitrogen determined, as shown in the following table:

Daily nitrogen balance in the digestion experiments.

Experiment No.	Kind of food and weights per day (in grams).	Nitrogen. In food.	In urine.	In feces.	Gain + or loss —.	Corresponding gain or loss of protein.
		Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*
18	Bread 630, milk 2,525	22.5	21.9	0.9	—0.3	— 1.9
19	Bread 430, milk 2,678	20.3	11.7	.6	+8.0	+50.0
20	Bread 315, beef 758	28.9	25.5	1.4	+2.0	+12.5
21	Bread 200, beef 333	13.7	12.6	1.0	+0.1	+ 0.6
22	Bread 365, milk 1,941, eggs 492	26.4	21.3	1.5	+3.6	+22.5
23	Bread 269, milk 1,897, eggs 390	22.5	16.3	1.1	+5.1	+32.5
24	Bread 279, milk 2,157, eggs 517	26.6	19.5	1.7	+5.4	+33.8
25	Bread 354, milk 942, eggs 402	19.0	12.6	.8	+5.6	+35.0
26	Bread 238, milk 2,550, oatmeal 120, corned beef 100, bananas 482, sugar 50	25.7	18.5	1.8	+5.4	+33.8
27	Bread 354, milk 638, oatmeal 78, corned beef 106, bananas 44 sugar 38, molasses 75	15.3	12.0	1.2	+2.1	+13.1
28	Bread 131, milk 2,609, oatmeal 65, corned beef 75, bananas 209, molasses 125	21.0	11.1	1.9	+8.0	+50.0
29	Bread 298, milk 2,100, oatmeal 119, sugar 59	19.8	14.5	1.4	+3.9	+24.4
30	Bread 353, milk 2,100, oatmeal 153, sugar 56	21.6	14.9	1.9	+4.8	+30.0
31	Bread 280, milk 2,190, wheatlet 175, sugar 38	20.4	20.1	1.6	—1.3	— 8.1
32	Bread 187, milk 2,166, wheatlet 61, sugar 56	16.3	12.6	.9	+2.8	+17.5
33	Bread 303, milk 2,350, corned beef 211, canned corn 760	29.4	24.1	3.4	+1.9	+11.9
34	Bread 382, milk 2,378, boiled ham 125, canned corn 425	24.3	24.0	1.8	—1.5	— 9.4
35	Bread 298, milk 2,350, corned beef 176, potato chips 119	25.5	19.3	1.3	+4.9	+30.6
36	Bread 205, milk 2,325, boiled ham 113, potato chips 90	20.0	19.2	1.2	—0.4	— 2.5

Nutrition investigations in Pittsburg, Pennsylvania, 1894–1896, ISABEL BEVIER (*U. S. Dept. Agr., Office of Experiment Stations Bul. 52, pp. 48*).—These investigations include six dietary studies of families living in Pittsburg, a study of the variation in cost and composition of bread in Pennsylvania, and a bakery experiment.

The dietary studies (pp. 7–43).—The studies were made with the families of a lawyer, two mill workmen, a boiler tender, a decorator, and a glass blower.

Tables are given showing the kind and amount of food purchased, wasted, and eaten, and its cost, composition, and fuel value. The average results are summarized as follows:

Results of dietary studies—cost and composition of food eaten per man per day.

Subjects.	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Professional man's family (No. 43)	21	91	145	380	3,280
Mill workman's family (No. 128)	13	85	104	307	2,575
Mill workman's family (No. 129)	9	77	90	314	2,440
Boiler tender's family (No. 189)	22	147	173	683	5,010
House decorator's family (No. 190)	20	112	144	368	3,305
Glass blower's family (No. 191)	16	94	121	385	3,085

The dietaries are discussed and compared with the results of similar studies made elsewhere.

In carrying on these investigations special attention was given to the amounts expended for food accessories—i. e., tea, coffee, condiments, flavorings, etc. It was found that, aside from tea and coffee, there was a comparatively small expenditure for such materials.

"In dietary No. 128, $24.52 was expended for food materials and $1.20 for food accessories. While this sum was not large, it should be remembered that as compared with the standards this family had insufficient nourishment. The conclusion seems warranted that they could have advantageously expended this sum for flour, bread, potatoes, beans, or the cheaper cuts of meat. This sum expended for flour at the price actually paid per pound for that purchased would have added 8 gm. of protein and 260 calories of energy per man per day to the diet. In the same way in dietary No. 129 the protein might have been increased 12 gm. per man per day and the fuel value over 400 calories.

"While tea and coffee are stimulating and refreshing as beverages, they are comparatively expensive and furnish little if any nutriment. Either cocoa, whole milk, or skim milk would furnish considerable nutriment besides being useful as a beverage. Of these materials the skim milk would furnish the largest food return for the sum expended."

Variations in the cost and composition of bread (pp. 43–46).—Ten samples of bread purchased in the open market were analyzed and the fuel value calculated and determined by the bomb calorimeter. The weight of the loaves and the cost per pound were also recorded. The results are compared with the results of a similar investigation made in New Jersey.[1]

"There is a much greater variation in the price per pound of bread than in its chemical composition, and, moreover, the variations in the latter bear little or no relation to those in the former. The lowest price per pound was 2¾ cts.; the highest, 7½; the average, 3¾ cts. The protein varied more than either the water or the carbohydrates, the lowest proportion being 9.2 per cent; the highest, 15.4 per cent; the average, 10.8 per cent."

The variations noted in fat and mineral content of the different samples were small and are regarded as unimportant. Variations in the water content were attributed to different methods of baking, while variations in protein and carbohydrate content were regarded as due to differences in the flour and other materials employed.

"The variations in cost are dependent almost entirely upon the baker. Different makes of bread sell at different prices per pound, while the nutritive value may be essentially the same in all cases. . . . As a rule, in the New Jersey samples, the larger the loaf the greater the cost per pound. The study in Pittsburg was too limited in extent to allow many definite deductions. The size of the loaf, apparently, had no direct bearing upon the price of the bread per pound. This depended rather upon the brand or trade name given by the maker."

Bakery experiment (pp. 46–48).—In the experiments made in New Jersey, mentioned above, baked bread was found to contain less fat than the materials from which it was made. To study this point further an experiment was conducted in a bakery in Pittsburg in which the materials and the bread made from them were analyzed. The results of the New Jersey investigation were confirmed.

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 35 (E. S. R., 9, p. 78).

"It would seem that either the fat is rendered partially insoluble in ether during the process of baking or that it has been volatilized. The fact that there is a very considerable loss in the fuel value of the materials in the bread as compared with that of the raw ingredients before baking indicates that the latter is the true explanation, for if the fats had simply been rendered nonextractable their heat of combustion would probably have remained unchanged and there would be no such pronounced loss of heat values as is actually the case."

The cost of the raw materials and of the bread made from them is also discussed. It was found "that raw materials worth $1.24 when made into bread sold for $2.60, or an increase of 110 per cent over the original cost."

A comparison of Utah feeding stuffs, L. FOSTER and L. A. MERRILL (*Utah Sta. Bul. 51, pp. 119–140*).—Experiments were made with nine lots of steers to test a number of Utah feeding stuffs and to compare indoor and outdoor feeding. Each lot contained 4 steers, with the exception of lot 6, which contained only 2. They were mostly 2-year-olds, of Shorthorn and Devon breed, with a few Aberdeen Angus and Holsteins.

The test, which began January 1, 1897, covered 90 days and was divided into two periods of 39 and 51 days, respectively. In most cases the steers were fed coarse fodder only during the first period of the test. Lot 1 was fed alfalfa, with barley in addition during the second period; lots 2 and 7, alfalfa and straw, with barley and bran during both periods; lots 3 and 8, corn fodder, with bran in addition in the second period; lot 4, timothy hay, with bran and pea meal in the second period; lot 5, alfalfa and shredded corn fodder 1:1, with the addition of bran and barley in the second period; lot 6, shredded corn fodder and roots, with the addition of bran in the second period; and lot 9, alfalfa with barley and bran in the first period and alfalfa and barley in the second.

Lots 1 to 6 were kept in the barn and were given some exercise each day in an open yard, and lots 7 to 9 were kept in yards with open sheds.

The financial statement is based on the following prices of feeding stuffs per ton: Alfalfa, $4; shredded corn fodder, $5; timothy hay, $6; bran, $10; barley, $16; peas, $20; roots, $3.50; and straw, $1.

The results for each lot are tabulated.

The principal conclusions reached were as follows:

"During the first period the gains were higher and less dry matter was required per pound of gain. The results add proof to the often repeated proposition that as the animal gains in flesh it requires a constant increase in the quantity of food for each additional pound of gain.

"For this single trial, feeding a grain ration with alfalfa during the preliminary period did not prove profitable.

"Roots had the effect of increasing the appetite without giving proportionate additional gain. From this and previous trials it may be inferred that roots can not be economically used in feeding simply for the nutrients they contain, being less profitable when so fed than the ordinary dry fodders.

"The results of three trials show that straw may be profitably used as a part ration in connection with alfalfa and grain. The experiment detailed herein shows, too,

that open-yard feeding gives a better appetite for the straw and enables the steer to make more profitable use of it.

"With the average Utah steer and our mild, dry winters, the best results, both in rate of gain and economic use of foods, are obtained by giving the animal the freedom of the corral and a good open shed that he may occupy at will.

"Timothy hay made the lowest and most unprofitable gain. Its relatively higher market price than alfalfa debars it from profitable use in cattle feeding.

"The average yield of the corn-culture experiments and the favorable results from the feeding of shredded corn fodder indicate that corn may be safely reckoned as one of the feeder's resources in Utah.

"In rate of gain when fed without grain, alfalfa stood the highest and timothy the lowest of the lots fed indoors.

"The quantity of dry matter required for a pound of gain was highest for alfalfa and lowest for corn fodder, with timothy ranking second highest.

"Comparing the proportion of digestible dry matter in the different foods, they stand as follows: Barley, 100; pea meal, 89; bran, 70; corn fodder, 68; alfalfa, 64; timothy, 63; straw, 51.

"In cost per pound of digestible dry matter, at the market prices quoted, pea meal was the highest and wheat straw the lowest."

Corn fodder is discussed at some length and the yields of corn per acre for several years at the station are quoted. In the dry atmosphere of Utah "corn fodder may be so thoroughly field cured that there is no danger of heating when shredded and stored where it is protected from the weather."

Wheat and corn as food for pigs, C. S. PLUMB and W. B. ANDERSON (*Indiana Sta. Bul. 67, pp. 61–70*).—Tests of the value of wheat and corn alone and in combination were made with 16 Chester White pigs, divided into four equal lots. Each lot consisted of 3 barrows and 1 sow. Lot 1 was fed corn; lot 2 dry wheat; lot 3 corn and wheat 1:1, and lot 4 wheat soaked in cold water. In addition all the lots were fed daily 10 to 12 lbs. of separator skim milk. After a preliminary period of 8 days, the test began January 9 and extended over 105 days. Each lot was confined in a separate inclosure of about 350 sq. ft., with a small pen attached.

To learn something of the time at which pigs may be most economically fattened, during two-thirds of the trial they were not fed all the grain they could have assimilated. During the latter part of the trial they were fed to their full capacity. The corn used was a yellow dent variety grown on the station farm. The greater portion of the wheat was an inferior grade which was purchased. Before feeding it was run through a fanning-mill. Chemical analysis did not show that it differed in composition from the wheat grown at the station. The financial statement is based on corn at 40 cts., wheat at $1.25, and skim milk at 8 cts. per hundred.

In general the pigs remained in good health throughout the test. One pig in lot 1 was sick for a day, and one in lot 4 was affected with scours. It was noticed that the pigs fed soaked wheat were somewhat inclined to looseness of the bowels though not seriously so. The pigs were weighed each week, and the data of the experiments are recorded in full in tabular form.

The following table shows the principal results of the trial:

Results of feeding wheat and corn to pigs.

	Food consumed.		Weight at beginning.	Average daily gain per pig.	Grain consumed per pound of gain.	Cost per pound of gain.
	Grain.	Skim milk.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*
Lot 1 (corn)	1,588.75	11.46	184.75	1.16	3.25	1.49
Lot 2 (dry wheat)	1,591.00	11.46	173.75	1.02	3.67	4.57
Lot 3 (corn and wheat)	1,591.00	11.46	175.50	1.12	3.59	2.97
Lot 4 (soaked wheat)	1,591.00	11.46	189.25	1.05	3.36	4.70

In order to learn the proportion of grain which passed through the pigs undigested the whole grains in three samples (weighing 5 oz. each) from the feces of each lot of pigs were counted. On an average the 5 oz. of manure from the lot fed corn contained 7 whole grains; from the lot fed dry wheat 1,167 grains; from the lot fed corn and wheat 685 kernels of corn and 12 of wheat, and from the lot fed soaked wheat 1,003 grains. The conclusion is drawn that wheat should be crushed or broken before feeding. A trial showed that 4 per cent of the wheat kernels from the feces of the lot fed dry wheat germinated. None of the undigested grains from the lot fed soaked wheat germinated.

A test was made of the strength of the bones of the pigs in each lot.

"Generally speaking, the result of these tests shows that the bones of the corn-fed lot crushed most readily, while those of the soaked-wheat lot crushed least readily. The principal feature of interest was that the bones of the corn-fed pigs seemed appreciably softer than those of the other three lots."

The organs and flesh of the different lots were weighed and examined, but no marked differences were observed.

Montana swine feeding, F. Beach (*Montana Sta. Bul. 14, pp. 19–33, pls. 2*).—A test was made with pigs to learn the value of alfalfa and of stubble fields for pasture and to compare barley with different mixtures of barley, wheat, and peas. On August 22, 9 brood sows (averaging 272.3 lbs.) and 44 pigs (averaging 57.1 lbs.) were turned on an alfalfa pasture of 4½ acres. The pigs were from 2 to 5 months old. They received 1 lb. of cracked barley per head daily, and were fed in a pen which was so arranged that they could pass in and out. The sows could not enter the pen and received no food in addition to the pasture. At the end of 6 weeks the sows on an average had gained 5 lbs. in weight. In 2 weeks the pigs made an average gain of 4.5 lbs. per week. Three pigs (boars) were then removed. In the 5 weeks following the remaining pigs made an average gain of 0.42 lb. per head daily. They were then turned into barley, wheat, and pea stubble fields of 18 acres, 10.44 acres, and 10.73 acres, respectively. They were not fed grain in addition to what they could find in the fields, except on stormy days, the grain thus fed amounting to 24.1 lbs. in 5 weeks. During this time the pigs made a gain of 22.8 lbs. per head, or 17.5 lbs. deducting the amount

which it was calculated they gained from the grain fed during stormy weather. On the supposition that 4.5 lbs. of grain are required to produce a pound of pork the 41 pigs gathered 3,238.75 lbs. of grain which otherwise would have been lost. The harvesting had been done in the usual manner, and in the author's opinion the amount of peas and grain remaining in the fields did not exceed that in the stubble fields on the average farm.

Seven brood sows were afterwards pastured during the winter on the station stubble fields, which included a 24-acre oat field in addition to those mentioned above. They were given no food in addition to what they could gather, except kitchen slops and a small grain ration on stormy days. "The sows frequently rooted down through 6 in. of snow and found sufficient grain to keep them in good condition throughout the entire winter."

November 21, 38 pigs from the lot which had been pastured on stubble fields, and 11 others, farrowed about the same time, were divided into one lot of 13 and three lots of 12 each. The pigs averaged about 120 lbs. in weight. They were pure and grade Poland Chinas and grade Chester Whites. Lot 1 was fed barley; lot 2, barley and wheat, 1:1; lot 3, barley and peas, 1:1; and lot 4, barley, peas, and wheat, 1:1:1. The barley and wheat were fed ground and dry, as it was found that when fed whole some grain passed through the pigs undigested. The peas were fed whole and were well masticated. The test was divided into three periods of 32, 21, and 23 days. One pig was dropped from lot 3 at the end of the first period.

The wheat was rated at $1, barley at 65 cts., and peas at 70.7 cts. per hundred pounds. The food consumed and gains in weight made during the different periods are recorded. At the close of the experiment the pigs were sold at 3½ cents per pound live weight.

During the first period the average daily gains for the four lots were 1.62, 1.65, 1.62, and 1.75 lbs., respectively; and the food consumed per pound of gain, 4.89, 4.64, 4.53, and 4.36 lbs. During the second period the average daily gains were 1.68, 1.63, 1.69, and 1.71 lbs.; and the food consumed per pound of gain, 5.05, 5.06, 5.01, and 4.82 lbs., respectively. During the third period the average daily gains were 1.21, 1.22, 1.15, and 1.27 lbs., the amounts of food consumed per pound of gain being 6.71, 6.45, 6.51, and 5.90 lbs.

Among the conclusions reached were the following:

"Pigs make the greatest gains and consume less grain per pound of gain before they reach 200 to 210 lbs. in weight.

"The quality of pork produced from wheat, barley, and peas in the various combinations used is firm and well adapted for the production of hams and bacon, the fat and lean of the meat being well distributed.

"Pigs fed on barley or barley and wheat at present market prices will pay for all food consumed when pork is 3½ cents a pound.

"The pea combined with grain is well adapted to the wants of the growing animal, and will give the greatest gains on the smallest amount of feed."

Some essentials of beef production, C. F. CURTISS (*U. S. Dept. Agr., Farmers' Bul. 71, pp. 24, figs. 17*).—The author discusses the most desirable type of cattle for fattening, mentions the characteristics of this type, and illustrates the use of the score card. Diagrams are given showing the method of cutting beef. The bulletin as a whole is based largely on experiments at the Iowa Station.

According to the author, animals suitable for fattening, "though representing different breeds, present that compactness of form, thickness, and substance, together with superior finish and quality, coupled with an inherent aptitude to lay on flesh thickly and evenly, that always characterizes the beef animal of outstanding merit." For fattening the prime requisite is general form. This point is discussed at some length.

The author points out that gains in weight are not a sufficient index of the gains in value in fattening animals. Thus, animals of different breeds may make approximately the same gains in the same period of time, yet in one case the gains may consist of fat accumulated around the viscera while the flesh remains lean. In another case the fat may be well distributed throughout the carcass, making juicy meat. These differences are very clearly brought out by the block test. The fact is noted that in recent years there has been a marked change in the kind of beef preferred. A very large overfat steer is no longer as desirable as the more compact animal of prime quality and medium size—that is, younger animals are more desirable than older ones.

"It is a well established principle in animal nutrition that young animals make more economical gains than older ones, and that the amount of food required for a given gain increases as the animal advances toward maturity." The economy of gain at different ages is discussed. In regions where coarse fodders and pasturage are abundant it may be desirable to extend the fattening period.

"In the great feeding section within what is known as the 'corn belt' the conditions are such as to favor the liberal policy of feeding from first to last, and under these conditions early maturity may be attained by a generous use of the ordinary feeding stuffs throughout the entire growing and fattening period, quite as well or even better than by too extensive use of the more concentrated and expensive grain feeds. That is to say, early maturity may be largely accomplished by the liberal use of the cheaper feeds of the farm, combined with a suitable grain ration, which may be quite moderate except in the finishing period. The modern feeder must combine the advantages of economy of production resulting from early maturity, and the excellence and enhanced value of the finished product that can only come from the right kind of stock well handled. This implies good breeding and continuous good feeding. These requirements are no longer merely subservient, but practically imperative."

Digestion experiments, J. A. WIDTSOE (*Utah Sta. Bul. 54, pp. 141–151*).—Experiments on the digestibility of shredded corn fodder, alfalfa hay, timothy hay, and a mixture of 71.5 per cent bran and 28.5 per cent shorts were made with steers. Two steers of common native stock were used and the ordinary methods were followed. The steers

were fed the rations tested for at least a month before the beginning of the experiments, which covered from 7 to 10 days. The coarse fodders studied were fed alone. Corn fodder was fed with the wheat bran and shorts, and its calculated digestibility was deducted in determining the digestility of the grain.

The coefficients of digestibility are shown in the following table:

Coefficients of digestibility of various feeding stuffs.

	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Shredded corn fodder:						
Steer 1	65.39	57.57	76.16	65.19	78.21	33.32
Steer 2	63.06	55.99	78.88	63.06	73.60	33.75
Average	64.23	56.78	77.52	64.13	75.91	33.54
Alfalfa hay:						
Steer 1	59.58	70.27	54.09	71.39	44.09	41.72
Steer 2	60.74	70.33	47.05	72.21	47.25	39.97
Average	60.16	70.30	50.57	71.80	45.67	40.85
Timothy hay:						
Steer 1	58.51	46.59	37.94	65.57	57.92	25.62
Steer 2	57.28	44.30	38.14	61.09	58.78	26.14
Average	57.90	45.45	38.04	63.33	58.35	25.88
Bran and shorts: Steer 1	58.14	75.75	44.98	64.25	18.33	7.50

The results are briefly discussed and compared with similar results obtained elsewhere.

Poultry, C. D. SMITH (*Michigan Sta. Rpt. 1896, pp. 109, 110*).—A brief report is given of the poultry kept at the station. Wheat was compared with corn as the principal ration for grown chickens. In addition to green food 2.8 lbs. of wheat or 2.77 lbs. of corn was required for a pound of gain. The cost of a pound of gain increased very rapidly as the chickens approached 5 lbs. in weight. A record was kept of the food consumed and eggs laid by three lots of 30 hens of the same age and breed having the same feeding and care. In six months lot 1 laid 2,232 eggs; lot 2, 2,357 eggs, and lot 3, 2,295 eggs. A record was also kept of the temperature of poultry houses with different areas of glass. The temperature was found to vary but little.

The nutritive value of Italian paste made wholly or in part of Indian corn, T. JACOANGELI and A. BONANNI (*Bol. Not. Agr., 19 (1897), No. 29, pp. 434-448*).—The authors discuss the food of the poor classes in Italy, calling attention to the fact that Indian corn is the principal food of the poor people in a considerable portion of the southern part of the Italian Peninsula and adjacent islands. It has usually been eaten in the form of polenta; that is, a porridge seasoned with fat, cheese, or other material. Many investigations have been made on the possibility of making satisfactory Italian pastes—i. e., macaroni, etc.—from corn alone or mixed with wheat. The authors report a number of experiments on the digestibility and comparative value of polenta and Italian pastes. In the first test the food consisted exclusively of polenta (corn-meal porridge) seasoned with a little lard, preserved tomatoes, and cheese. In the other tests the food consisted entirely of Italian pastes made of corn,

wheat, or a mixture of the two, which were eaten in the form of a thick soup. In accordance with the usual custom the food was taken in two meals—one at 10 in the morning and the other at 4 in the afternoon. Water was the only beverage used, the quantity consumed varying little from day to day.

The coefficients of digestibility and the income and outgo of nitrogen during the different tests are shown in the following table:

Results of experiments with polenta and Italian pastes.

Food consumed per day.	Coefficients of digestibility.				Nitrogen—			
	Dry matter.	Protein.	Fat.	Carbohydrates.	In food.	In urine.	In feces.	Gain.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Corn-meal porridge 2,912 gm	91.50	75.6	84.99	94.66	11.03	7.81	2.69	0.53
Soup from corn-meal paste, 3,459 gm	94.77	89 81	85.98	96.31	13.35	10.51	1.36	1.48
Soup from paste ¾ corn meal, ¼ low-grade flour, 3,117 gm	94.91	90.54	86.79	96,49	14.01	10.97	1.37	1.67
Soup from paste of best wheat flour, 2,859 gm	96.09	91.22	87.56	97.46	13.45	10.63	1.19	1.63
Soup from paste of ⅔ corn meal and ⅓ low-grade flour, 3,077 gm	94.78	90.33	85.76	96.31	13.33	10.44	1.29	1.60
Soup from paste of low-grade flour, 2,814 gm	94.79	90.76	86.19	96.31	14.39	11.67	1.33	1.39

The authors discuss the experiments at considerable length. The following general conclusions were reached:

The Italian pastes made from corn meal are much better assimilated than the porridge. In this respect they are nearly equal to the pastes made from the finest quality of wheat flour. The corn-meal pastes furnish a food product in which digestible protein may be obtained at a less cost than in corn-meal porridge or wheat pastes of different qualities. It is believed that such pastes will prove of the utmost importance in dietaries of people of limited income.

The composition and food value of bread purchased in Lisbon in March, 1892, A. DE SEABRA (*Sur la composition et la valeur alimentaire du pain du marché de Lisbonne, aus mois de mars, 1892. Lisbon: Libanio da Silva, 1897, pp. 14*).—The composition and digestibility of a number of kinds of Portuguese bread are reported. Few details of methods followed are given.

"Chocolate" oats, BALLAND (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 18, pp. 1289-1291*).—The name "chocolate" oats is applied to oats which have acquired a brownish color from exposure to rain and sun. The composition of such oats and oats of normal color, grown near Mostaganem, is reported.

The value of the kola nut as a part of a ration, L. BERNEGAU (*Die Bedeutung der Kola-Nuss als Beifutterstoff. Altona: 1897; abs. in Bot. Centbl., 73 (1898), No. 12, p. 460*).—A brief account is given of a feeding experiment with the kola nut in Madagascar. The author also reports investigations with horses. The addition of kola feeding stuff to the ration enabled the horses, in his opinion, to perform more severe labor, while at the same time they did not lose weight if the ration was diminished.

Milk as food (*U. S. Dept. Agr., Farmers' Bul. 74, pp. 39, charts 2*).—This is a popular bulletin, discussing the composition, chemistry, variations, nutritive value, and digestibility of milk and the comparative value of skim milk, cream, and buttermilk. The use of milk in combination with other foods is treated of and a number of daily menus containing large and small amounts of milk are given.

Vinegar, E. F. LADD (*North Dakota Sta. Bul. 32, pp. 278, 279*).—A number of samples of so-called pure cider vinegar were examined. In the author's opinion there is much deception practiced, and the term "pure cider vinegar" does not give a fair indication of the product sold under that name in many cases.

Coloring matter in confections, C. B. COCHRAN (*Pennsylvania Dept. Agr. Rpt. 1897, I, pp. 529-535*).—The author examined 21 samples of candy. Of these 16 were

found to be colored with coal-tar colors. In addition to sucrose, which was found in all the specimens, nearly all the candies contained glucose and many starch and dextrose. No excess of mineral matter or other injurious substance, unless the coal-tar colors be regarded as injurious, was found.

A number of artificial digestion experiments are reported on the effect produced by the coal-tar colors, auramin, Bismarck brown, rhodamin, rose bengal, eosin, acid magenta, and methyl violet. The effect of all these coloring matters upon peptic digestion was studied and the effect of rhodamin, methyl violet, and eosin upon pancreatic digestion. In all the tests 0.125 gm. of the coloring was used with 100 cc. of the digestive ferment solution and 1 gm. of beef.

"In every case the presence of a coal-tar color exerted some retarding influence on digestion. The results indicate that eosin and acid magenta interfere decidedly with peptic digestion and that methyl violet produces just as decided interference with pancreatic digestion. . . .

"It therefore seems to me safe to assert that any substance so totally foreign to food as a coal-tar dye, which can be shown, when used in reasonable amounts, to retard artificial digestion, must rest under grave suspicion."

Handbook of subsistence stores (*U. S. War Dept., Office Commissary General of Subsistence, Doc. 19, pp. 199, fig. 1*).—The foods, condiments, and other materials included under the head of subsistence stores for the United States Army are described. In many cases processes of manufacture are given, as well as statistical and other information of a useful character. Among other points the effect of freezing and of heat on canned goods is discussed.

Subsistence manual (*U. S. War Dept., Office Commissary General of Subsistence, Doc. 21, pp. 57*).—In addition to matter concerning the purchase and transportation of subsistence stores, information is given concerning the rations, food materials, and care of food and other stores supplied by the Subsistence Department of the United States Army.

Silage, C. D. SMITH (*Michigan Sta. Rpt. 1896, pp. 107–109*).—The yield per acre and composition of corn cultivated in different ways and of sorghum raised for silage is given. The sorghum silage kept well. Owing to the woody stems it contained a high percentage of crude fiber which was not relished by the stock.

The velvet bean (*Florida Agr., 25 (1898), No. 13, p. 176*).—Notes are given on the value of the velvet bean for green manuring and on the use of the green beans as food. The latter shelled and cooked caused serious although not fatal illness.

Feeding value of potatoes, C. D. SMITH (*Michigan Sta. Rpt. 1896, p. 107*).—This is a brief summary of work reported in Bulletin 149 of the station (E. S. R., 9, p. 1081).

On the influence of muscular exercise, sweating, and massage on metabolism, J. C. DUNLOP, D. N. PATON, R. STOCKMAN, and I. MACCADAM (*Jour. Physiol., 22 (1897), No. 1–2, pp. 69–92*).—Five experiments were made with men. In three the effect of excessive muscular exercise was studied, in one the effect of sweating, and in one the effect of massage. The food, urine, and feces were analyzed and the income and outgo of nitrogen was determined.

From the experiments the following conclusions were reached: Sweating and massage does not produce any marked influence on metabolism.

"Excessive muscular work causes an increased catabolism of protein, this being shown by the increased excretions of nitrogen and of sulphur in the urine. The protein consumed is muscle protein, shown by the increased nitrogen and sulphur excretions not being accompanied by increased excretions of uric acid, extractive nitrogen, and phosphorus, muscle being a tissue poor in nucleo proteins which produce these waste products. If the subject who performs excessive muscular work be in poor training, this consumption of muscle protein is accompanied by the consumption of the protein of other tissues which contain nucleo proteins, as shown by the increased excretions of uric acid, extractive nitrogen, and phosphorus.

There may here be a withdrawal of protein from other structures to effect repair in muscles, similar to the transference of material seen in starvation, the protein portion being retained, while the nucleic acid portion is excreted. . . .

"Our conclusions show the importance of two points long known to athletes and others doing excessive muscular work. The one is the importance of proper training, for by it an abstraction of proteid matter from tissues other than muscle can be avoided; the other is the importance of their being a sufficiency of protein in the diet to compensate for the loss which occurs. An abundance of protein in the diet of an athlete has other functions to fulfill beside this. It is required during training for building up the energy liberating mechanism—the protoplasm of muscle—and it is also required after work to repair that mechanism. The benefits of training are well known in other ways, such as preparing the heart for suddenly increased duty and limiting the after fatigue effects."

Muscular exertion and gaseous exchange, L. SCHNYDER (*Inaug. Diss., Bern. Munich: R. Oldenbourg, 1896, pp. 33, figs. 2*).—A number of experiments with man in which the respiratory quotient was determined are reported. Some of the subjects were in health, others were convalescent. The principal conclusions reached were that muscular work increases metabolism, as shown by the increased production of carbon dioxid. The increase, however, is diminished if the labor is continued until it becomes habitual. In the same way an improvement in the general physical condition—that is, a gain in strength—lowers the increased metabolism.

Investigation on the source of muscular energy, K. KAISER (*Ztschr. Biol., 36, No. 3, pp. 358–410, pl. 1*).—A number of experiments were made with the muscles of frogs. The subject of muscular energy is discussed from a mathematical standpoint.

A further study of the influence of alcohol and alcoholic drinks upon digestion, with special reference to secretion, R. H. CHITTENDEN, L. B. MENDEL, and H. C. JACKSON (*Amer. Jour. Physiol., 1 (1898), No. 2, pp. 164–209*).—Supplementing previous work on the effect of alcohol and alcoholic drinks upon the processes of digestion (E. S. R., 7, p. 971), the authors made a number of experiments with dogs. Some of the more important conclusions follow: The presence of strong alcohol or an alcoholic beverage in the mouth has a direct stimulating effect, causing for a short time an increase in the flow of saliva. Not only is the volume of saliva increased, but also the amount of organic and inorganic constituents. This effect is not peculiar to alcohol, but is common to dilute acid (vinegar), ether vapor, etc., and is analagous to the effect produced by electrically exciting the nerves of the salivary glands. It was not found that alcoholic fluids absorbed from the stomach had any influence upon the amount or composition of the saliva. Thus, when alcohol was introduced directly into the stomach of dogs by injection through the stomach wall no effect upon the salivary secretion was observed. "Hence, so far as our results go, alcohol and alcoholic fluids are without any specific effect upon the secretion of saliva except to produce a transitory stimulation of secretion while in the mouth cavity."

Alcohol or alcoholic fluids increase very greatly the flow of gastric juice and its content of acid and total solids. That is, it contains more acid, more solid matter, and more combined hydrochloric acid than the ordinary secretion. It is also strongly proteolytic. An increase in the secretion of gastric juice is produced not only by alcoholic fluids in the stomach, but also indirectly by alcohol absorbed from the intestine, even if the latter is ligated.

"If these results are considered in connection with our previous observations upon the influence of alcohol and alcoholic drinks upon the purely chemical processes of gastric digestion, it is seen that side by side with the greater or lesser retardation of digestive proteolysis caused by alcoholic beverages there occurs an increased flow of gastric juice rich in acid and of unquestionable digestive power. The two effects may thus normally counterbalance each other, though it is evident that modifying conditions may readily retard or stimulate the processes of the stomach according to

circumstances. Foremost among the latter is the rapid disappearance of alcohol from the alimentary canal. . . . This point has been very carefully and thoroughly tested by numerous experiments on healthy dogs with gastric fistulæ, using proteid test meals, with the result that certainly in the stomach of dogs digestion is not retarded in any pronounced degree under the influence of alcohol or alcoholic fluids. Of hastened digestion the results obtained gave little or no suggestion, and we must therefore conclude that the two diverse factors above referred to more or less counterbalance each other, so that gastric digestion in the broadest sense of the term is not markedly varied under the influence of alcohol or alcoholic fluids. . . . In view of the rapid disappearance of alcohol from the intestinal tract it is plain that alcoholic fluids can not have much, if any, direct influence upon the secretion of either pancreatic or intestinal juice."

Note on the digestion of starch in the stomach, W. G. A. ROBERTSON (*Proc. Roy. Soc. Edinburg, 21 (1895–1897), pp. 96–104*).—A number of experiments were made with diseased and healthy men on the digestibility of starch by ptyalin, the digestion of starch in the stomach, and the combined effect on starch of gastric and salivary digestion.

Does the Stutzer method of artificial digestion furnish reliable data for deductions concerning the digestibility of protein? A. SANOTSKI (*Zap. Novo-Alexandri Inst. Selsk. Khoz. i Lyesor, 10 (1897), No. 2, pp. 1–17*).—The author criticises Stutzer's method of artificial digestion and believes too sweeping deductions should not be drawn.

On the value of asparagin in feeding herbivora, O. KELLNER (*Verhandl. Gesell. Deut. Naturf. u. Aerzte Braunschweig, 68 (1897), pp. 110–112*).—A brief report of experiments previously noted (E. S. R., 9, p. 1079).

The poisons developed in foods during fermentation or putrefaction, with two illustrative cases, F. T. ASCHMAN (*Pennsylvania Dept. Agr. Rpt. 1897, I, pp. 727–736*).—A general discussion of the subject.

On a Soudanese grass, DYBOUSKI (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 10, pp. 771, 772*).—The author gives the composition of the seed of *Paspalum longiflorum* and compares it with other well-known cereals (E. S. R., 10, p. 79). This grain is used to a considerable extent for food.

Beets and the feeding of dairy cows; value of forage beets and dried and ensiled cossettes, L. GRANDEAU (*Jour. Agr. Prat., 62 (1898), No. 10, p. 345*).

On the origin of polled cattle, E. O. ARENANDER (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 468, 469; II, App. 13, pp. 13, map 1*).

On the influence of the temperature of the stable on the productive capacity of farm animals, E. O. ARENANDER (*Landtmannen, 9 (1898), Nos. 11, pp. 171–173; 12, 189–191*).

Fattening lambs, F. B. MUMFORD (*Michigan Sta. Rpt. 1896, pp. 267–285*).—A reprint of Bulletin 128 of the station (E. S. R., 7, p. 887).

Lupines for pigs, HORNUNG (*Deut. Landw. Presse, 25 (1898), No. 36, p. 394*).—A brief account, condensed from *Mittheilungen der Vereinigung deutscher Schweinzüchter*, is given of feeding lupines to pigs. The test reported, which was of 107 days duration, was made with 2 pigs. They were fed daily 1.5 lbs. peas, 1 lb. beans, 1 lb. barley, 1 lb. coarse wheat bran, 3 lbs. potatoes (poor quality), 0.5 lb. lupines, 0.125 lb. peanut meal and molasses, 0.25 lb. molasses with a little milk and buttermilk. The pigs weighed at the beginning 332 lbs. and gained 85.5 lbs. per pig at a cost of 9.5 cts. per pound.

The feeding and watering of horses, D. HUTCHEON (*Jour. Jamaica Agr. Soc., 2 (1898), No. 5, p. 172*).—A general article.

Advantages and disadvantages of modern methods of poultry culture, S. CUSHMAN (*Agr. Massachusetts, 1897, pp. 95–115*).—A paper presented at the public winter meeting of the Massachusetts Board of Agriculture at Taunton, in 1897, with a discussion.

DAIRY FARMING—DAIRYING.

Some points in the physiological chemistry and coagulation of milk, D. F. HARRIS (*Proc. Roy. Soc. Edinburgh, 21 (1895–1897), pp. 72–89*).—The author studied the physical-chemical condition of caseinogen in milk, the chemistry of the coagulation of caseinogen, the chemistry of casein, the digestion of milk, etc. He uses the term caseinogen to mean casein as it exists naturally in the milk, before it is coagulated. With reference to the caseinogen he concludes that—

"Caseinogen is not, in the ordinary acceptation, in solution in milk plasma. It is in the most intimate association with the fat; in all probability the particles consist of fat in direct ratio and of caseinogen in indirect ratio to their bulk. In this sense caseinogen is 'particulate.'

"The arguments that caseinogen is present as an envelope are still entitled to respect; but there is some evidence pointing to this proteid being interstitially associated with the fat.

"Both the clots and precipitates in milk and in 'pure' caseinogen are more or less cohesive agglutinations of the preexisting particles; there is no trace of fibrous structure.

"The so-called 'pure solutions' of caseinogen are suspensions of particles upon whose presence depends their coagulability, in which respect they resemble diluted milk or concentrated whey. Their pressure-filtrates contain no proteid."

The author's experiments confirm Ringer's view that the coagulation of casein is a twofold process, the first stage being the conversion of caseinogen by rennet into a soluble form of casein, which he calls procasein; and the second stage, the precipitation or solidification of this procasein into a more or less cohesive clot or curd (casein).

By analyses of acetic-acid whey and rennet whey the author shows that "there is some chemical difference between the precipitation of caseinogen by an acid and the clotting of it by rennet—a difference able to be expressed, at least, in terms of the union of calcic phosphate. Some call this clot a caseate of calcium. Normally in milk it may be so."

The effect of various salts on the curdling of milk was studied, and the curdling of milk from which the lime had been removed by precipitation with potassium oxalate and centrifugal force, using decalcified rennet.

"Only the soluble salts of calcium, barium, and strontium can precipitate procasein. They are concerned only with the second stage of clotting. . . .

"One factor in the inhibition of clotting by certain potassium salts is the high alkalinity.

"The absence of lime is a more powerful inhibitant than the presence of potash."

The experiments with artificial digestion of milk which had received different treatment lead to the following statements:

"My experiments with milk mixed with water or with CaH_2O_2, in order to render it more digestible, as it is alleged, tend to show that this property is entirely due to the greater laxity of the clot which forms when the solid particles of milk are, from any cause, separated from one another. Evidently the power of rennin for binding

particle to particle is weakened when it has to act through a greater distance upon these particles. None of these clots in diluted milk has the absolute laxity of the pancreatic clot in milk. . . .

"I have confirmed Budin's observations as to the superior digestibility of milk heated to 100° C. . . .

"Milk boils at 104.5° C. I have corroborated the statement that fresh milk yields a blue color with tincture of guaiac, while boiled milk does not.

"I am unable to substantiate the statement of authors that boiled milk is 'far more difficult to coagulate than unboiled milk.' . . .

"Authors state that this 'difficulty' is due to some of the calcic phosphate having become insoluble. I can find none of it upon prolonged centrifugalization."

Some investigations concerning separator slime, BARTHEL (*Nord. Mejeri Tidn., 12 (1897), Nos. 42, pp. 495, 496; 43, p. 507, ill.*).—The author discusses the formation and composition of separator slime, and shows that the slime will vary in amount and character according to the care taken in drawing and handling the milk. The difference between the bowl slime deposited on the inner wall of the Alpha separator bowl and the "separator dirt," the deposit found at the lower end of the central inlet tube serving as a stand for the Alpha discs, is considered. The latter is dark gray, of a sandy and dry consistency, and contains macroscopic impurities, like parts of insects, animal and human hairs, particles of wood, etc. Viewed under the microscope it is found to contain more solid impurities and less casein and bacteria than the bowl slime, and is especially rich in epithelial cells, which occur only in small quantities in the bowl slime. The separator dirt makes up from 4 to 8 per cent of the total quantity of slime. The difference in the ash contents of the two kinds of slime is marked. The dry substance of the bowl slime was in one instance found to contain 7.1 per cent of ash, against 14.1 per cent in the dry matter of the separator dirt.

The total amount of separator slime obtained in 50 trials varied from 0.02 to 0.04 per cent of the milk separated, the average amount being 0.03 per cent. The average water content was 65 per cent, with variations from day to day of 3 to 4 per cent. The machine used was a Turbine Alpha-Pony separator.

The relation between the separating temperature, the acidity of the milk, and the amount of slime obtained is shown by the following results:

Relation between temperature, acidity of milk, and amount of slime.

	Temperature ° C.									
	40	45	50	55	60	65	70	75	80	85
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Lactic acid	0.160	0.165	0.167	0.165	0.168	0.156	0.160	0.165	0.165	0.161
Separator slime	.032	.038	.040	.045	.041	.030	.028	.044	.036	.046

The increase in percentage of slime with increasing acidity of the milk is due to the greater separation of the casein under these condi-

tions. Below 70° C. there is a direct increase of slime with the increase in acidity, but above 70° the amount of slime depends on the heat and not on the degree of acidity. Abnormal conditions in the milk (e. g., admixture of colostrum milk) decidedly influence the slime formation. In case of cows attacked with foot-and-mouth disease the slime content of the milk has been found to reach 0.3 per cent of the amount of milk separated, instead of the normal 0.03 per cent.—F. W. WOLL.

Skimming and churning in Swedish creameries, N. ENGSTRÖM (*Tidskr. Landtmän, 18 (1897), Nos. 38, pp. 685–689; 39, pp. 695–698*).—Investigations were conducted during the spring and fall of 1897 to study the losses of butter fat in skimming and churning in the Swedish creameries participating in the periodical butter exhibitions. In all, 508 samples of skim milk were examined, about half of this number being separated at pasteurizing temperature (65 to 85° C.) and the rest separated at 25 to 35° C., with the exception of 35 samples which were from the gravity cold-setting system. Over half of the samples were taken in the spring and the remainder in the fall. In sampling the skim milk, samples of 500 cc. each were taken every half hour on five successive days, and 50 cc. of the united daily samples were used. Ninety per cent of the samples were from De Laval separators, nearly all of which were Alpha separators.

As between the two kinds of Alpha separators, old and new, the average fat content of the skim milk from old-model machines was, pasteurized, 0.09 per cent; unpasteurized, 0.13 per cent; and from the new-model machines, pasteurized, 0.10 per cent; unpasteurized, 0.13 per cent. From 90 to 95 per cent of the samples from pasteurized milk contained under 0.15 per cent fat, and 55 to 60 per cent under 0.1 per cent. Where the skimming was done at lower temperatures the fat content of the skim milk was under 0.15 per cent in 60 to 70 per cent of the cases, and under 0.2 per cent in 86 to 90 per cent of the cases.

The samples of buttermilk analyzed, numbering 459 in all, were composites from the churnings of several successive days. The average results obtained are shown below, with variations. The loss of fat in the buttermilk per 100 kg. of whole milk is also given in the table.

Analyses of samples of buttermilk.

	Fat content of buttermilk.		Loss of fat in buttermilk, per 100 kg. of whole milk.	
	Pasteurized.	Unpasteurized.	Pasteurized.	Unpasteurized.
	Per cent.	*Per cent.*	*Kg.*	*Kg.*
Maximum	1.48	0.91	0.26	0.20
Minimum	.18	.20	.02	.02
Average	.38	.38	.047	.053

The samples from pasteurized milk contained, on the average, the same amount of fat as those from the unpasteurized milk, while the

average loss of fat in the buttermilk per 100 kg. of whole milk, was slightly less in case of the samples from pasteurized milk. This result is contrary to the teachings of the Danish pasteurization experiments (E. S. R., 2, p. 492). The average loss of fat from both pasteurized and unpasteurized milk was 0.049 kg.—F. W. WOLL.

Butter fat in cheese (*Pennsylvania Dept. Agr. Bul. 34, pp. 62–71*).—"In order to settle, in a practical manner, the question of fact as to whether the standard of 32 per cent of butter fat in a full-cream cheese was impracticable, Professors Aschman, Frear, and Cochran were directed to have 100 samples of cheese selected in their respective districts and have them carefully tested for their percentage of butter fat, and it was agreed by all parties interested that the result of this test should be deemed conclusive."

The results of these analyses are tabulated, Aschman's average being 32.6 per cent of fat; Frear's, 35.3, and Cochran's, 33.6.

"While a number of samples ran below the full-cream standard, there is evidence for the belief that they were in reality 'skim-milk' cheese, and would come under one of the lower classifications of the law, but few falling below that of 'three-fourths cream,' which requires the presence of 24 per cent of butter fat."

"[The conclusion is reached] that the standard of 32 per cent of butter fat for a 'full cream cheese' is not too high and is readily attainable by any careful and practical manufacturer, and that it is in favor of rather than against the manufacturer."

To study the variation in the composition of samples taken from different parts of the same cheeses, series of samples were examined by the above analysts, and the results are given. It was found that—

"The slight variation in the amount of butter fat in different portions of the same cheese, the rind being discarded, is not of sufficient amount to influence results, and that even this slight variation may be avoided by taking the samples with a cheese 'trier,' which insures a fair section of the cheese."

To test the variation in fat content of cheese made under practically the same conditions on different days, cheese made by one maker on ten successive days was analyzed. All of the samples contained over 39 per cent of fat, and the variation between the maximum and minimum was 3.42 per cent.

"Under proper management the variation caused by the milk of different days is not of sufficient importance to modify results, especially as it is not the intention of the department to prosecute upon close or small margins."

The fat content of a number of samples of fancy cheese is given, with the selling price per pound.

The college herd, C. D. SMITH (*Michigan Sta. Rpt. 1896, pp. 102–106*).—The individual record is given for 12 cows for one year, showing the amount and cost of the food eaten, amount of milk and butter produced, profit, etc. The yield of milk ranged from 4,946.6 to 16,981 lbs.; the calculated yield of butter from 173 to 652 lbs.;

the cost of food per pound of butter from 5.5 to 16 cts.; and the net profit from $6.08 to $94.05. Except in the case of one cow, the cost of butter was under 9 cts., and the net profit for the year exceeded $22.

The 3 cows giving the greatest net profit were the 3 cows consuming the most feed. . . . On the other hand, College Dame Le Brocq, the average per cent of fat of whose milk was 6.33 per cent, returned, on account of her large yield of fat, a net profit of $42.99, although her total cost of feed was but $36.40, an expense less than that of any other cow in the herd save one. . . .

"These cows vary, evidently, in their capacity to eat and digest food; they vary also in their capacity to return in butter fat an amount corresponding to the feed consumed."

Dairy records, C. D. SMITH (*Michigan Sta. Rpt. 1896, pp. 223–266, figs. 8*).—A reprint of Bulletin 127 of the station (E. S. R., 7, p. 885).

On the occurrence of tubercle bacilli in market butter, L. RABINAWITSCH (*Ztschr. Hyg. u. Infektionskrank., 26 (1897), p. 90; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20–21, pp. 610–612*).

Some of the dangers surrounding the dairy, E. F. BRUSH (*Dietet. and Hyg. Gaz., 14 (1898), No. 3, pp. 142–144*).

Annual reports of the butter and cheese associations of the Province of Ontario, 1897 (*Toronto: Ontario Dept. Agr., 1898, pp. 175*).—This contains the proceedings of the annual meeting of the associations, including various papers on the feeding and management of dairy stock, butter making, cheese making, creamery management, etc., with a list of members, financial statements, etc. The papers are largely quite popular, those by the college and station officers being based on work reported in detail elsewhere.

Annual reports of the dairymen's and creameries' associations of the Province of Ontario, 1896 (*Ontario Dept. Agr. Rpt. 1896, I, pp. 1–280*).—The proceedings of the annual meetings of these associations.

Report of cooperative dairy experiments for 1896, H. H. DEAN (*Ontario Dept. Agr. Rpt. 1896, I, pp. 256–258*).—A very brief account is given of cooperative experiments made by private parties on the effect of an increase in the fat content of the milk on the yield and quality of cheese, effect of milling curd at different stages of acidity, effect of putting curd to press at different temperatures, and effect of washing on quality of butter.

Dairy bulletin by the dairy school, Guelph (*Ontario Agr. Col. and Expt. Farm Bul. 107, pp. 32*).—This consists of popular articles by different authors on methods of sewage disposal, milk testing, care of milk for cheese factories and creameries, making a starter, separators and the separation of milk, butter making in the creamery, butter making on the farm, and cheese making.

On the milk trade in large European cities, W. MUNTHE-KAAS (*Tidsskr. Norske Landbr., 5 (1898), No. 3, pp. 97–119*).

Composition of human milk, A. H. CARTER and H. D. RICHMOND (*Brit. Med. Jour., 1898, I, pp. 199–203; abs. in Jour. Chem. Soc. [London], 1898, No. 425, p. 175*).

Cheese yeasts and their systematic application in practice, O. JOHAN-OLSEN (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 465–468; II, App. 17. pp. 9, ill.*).

The best medium for lactic acid ferments, O. JENSEN (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 5, pp. 196–199*).—The author found a particular kind of peptonized milk furnished the best medium for a number of lactic ferments.

A preliminary bulletin on the pasteurization of milk, C. D. SMITH (*Michigan Sta. Rpt. 1896, pp. 413–442, figs. 6*).—A reprint of Bulletin 134 of the station (E. S. R., 8, p. 630).

On the manufacture of Thyboe cheese, B. BOGGILD (*Ugeskr. Landm., 43 (1898), No. 13, pp. 162–164*).

Branding cheese (*Pennsylvania Dept. Agr. Bul. 34, pp. 50–52*).—A discussion of the State law requiring the branding of cheese, with some of the difficulties that have been met.

United States vs. Canadian cheese in England, DICKINSON (*U. S. Consular Rpts., 1898, No. 212, pp. 109–111*).—Statistics are quoted on the export of cheese from Canada and the United States to England. Considerable more cheese was imported from Canada than from the United States. The Canadian cheese was valued at 9.12 cts. per pound and the United States cheese at 9.23 cts.

VETERINARY SCIENCE AND PRACTICE.

On a new infectious disease of cattle, G. BOSSO (*Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 18–19, pp. 537–542, pl. 1*).—A disease discovered in the neighborhood of Pavia, Italy, is described which is similar to charbon or hemorrhagic septicemia, but can not be classed as either. It appeared suddenly, developing the following symptoms: Temperature, 39° C.; cud-chewing slow, almost none; weakness in the lumbar region and hinder parts; continued attempt to pass feces; suffering severe. After three or four days the animal's strength disappears and it succumbs, moaning painfully.

In a herd of 21, 6 died. The disease was found on wet places and has been observed on dry or high ground. Infection appears to be through drinking water and food. Autopsy showed the heart, caronal arteries, and veins about the *sulcus ariculo ventricularis* crowded with ecchymoses from the size of a needle point to that of a needle head. The entire surface of the ventricles was covered with them. The blood was reduced to a thin coagulum. The cardial lymph vessels were very noticeable and were abnormally swollen. The kidneys were very hyperemic, dark red to violet, inclined to black.

Culture studies brought to light a motionless bacterium $1\frac{1}{2}$ μ by 0.5 to 0.8 μ in size, which resisted many of the usual staining reagents and withstood Gram's decolorizing method. Some obtained from the kidneys, where they are very numerous, measured 2.7 μ long. Injection experiments with guinea pigs, dogs, and white mice resulted fatally in 18, 18 to 24, and 60 hours, respectively.

Histological studies showed that the chief alterations occur in the Malpighian glomerules of the kidneys, where there was found great changes in the vascular walls and a great increase in the number of muscles in the endothelium of the vascular loops and the scaling of the outer epithelium of Bowman's capsules, all of which may be characterized as *Glomerulo nephritis*. The specific organisms can be found in large numbers inside the vessel cells in the lymph spaces.

The disease is very different from the new septicemia with nephritis described by Thomassen as occurring in cattle, some of the differences appearing in the turbid urine in the latter disease and the motile organism. The organism is also distinct from that found in cases of nephritis found by Hess, Pflug, Mazanti, Rivolta, Mircoli, and others.

Some diseases of cattle, N. S. MAYO (*Kansas Sta. Bul. 69, pp. 103–134, figs. 2*).—This gives a brief popular account of Texas itch, blackleg or symptomatic anthrax, tuberculosis, and Texas fever.

From various parts of the State reports were received of a skin disease, identified as Texas itch, caused by the mite *Psoroptes communis bovis*. In the outbreaks observed the mite was introduced on cattle from the ranges of the South and West. The disease spreads rapidly through a bunch of cattle, apparently by contact of the diseased and healthy animals, and indirectly by posts, feed-racks, etc. As remedies, emulsions of creolin and zenoleum (the latter in the proportion of 1 to 3 and applied with sponges, cloths, and scrubbing brushes) gave the best results. The cost is 2 to 3 cts. per head. The lime-sulphur remedy is also recommended.

In opposition to the usual statement that blackleg is more prevalent in low and wet lands, the fact is noted that it seems to cause greater losses in the western part of Kansas, where the altitude is almost 4,000 ft. and the rainfall less than 20 in., than in the eastern part at an altitude of less than 1,000 ft. and an annual rainfall of nearly 40 in. Treatment is thought unsatisfactory and the best remedy is prevention by vaccination.

The results of tuberculin tests are given. From the fact that, according to records collected from various sources, of 11,394 cattle tested in the United States 5,759 reacted, and that the number of errors was 12 or about 1 in 950, the author concludes that the test is very reliable. From the same sources it was found that different breeds seem to be affected in different degrees, as shown in the accompanying table:

Table showing the distribution of tuberculosis by breeds.

Breed.	Number tested.	Number reacting.
Jersey, pure and grades	111	77
Shorthorn, pure and grades	293	91
Holstein, pure and grades	283	127
Ayreshire, pure and grades	18	112
Guernsey, pure and grades	13	7
Devon, pure and grades	20	11
Red Polled, pure and grades	7	3
Aberdeen-Angus, pure and grades	13	8

Experiments were performed in infecting cattle with Texas fever by means of *Boophilus bovis*, which completely confirmed conclusions arrived at by Dinwiddie, Francis, Connoway, and the Bureau of Animal Industry. An account is given of several outbreaks of Texas fever. In one case infected cattle were shipped into Kansas from north of the national quarantine line, but were found to have first come from south of it. In another case 170 head of cattle from California communicated the disease to a herd of 350 natives, 30 of which were lost. The comparatively small loss is attributed to the small number of ticks on the California cattle.

Although remedial treatment is not satisfactory, it is thought that some relief may be given by removing sick cattle to shady and comfortable quarters, drenching them with sweet milk and removing the ticks. The quarantine method is the most effective remedy.

A case of a contagious epidemic of pseudotuberculosis in sheep, TURSKE (*Ztschr. Milchhyg., 9 (1897), No. 7; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20-21, p. 615*).—At a slaughterhouse in Danzig 11 out of a flock of 150 8 to 12 year-old sheep were found infected with a disease identified as pseudotuberculosis. Enlarged glands, which were somewhat evident before death, came to light when the animals were slaughtered. These glands contained abscess-like formations of a greenish yellow color, but neither caseous nor crumbly.

Report of the meeting of the German naturalists and physicians at Brunswick, O. VOGES (*Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 22-23, pp. 685-693*).—One of the prominent facts brought out in the summary of the papers read on tuberculosis at the meeting is that milk may be tuberculous without the udder itself being affected.

An investigation for the repression of beri-beri, C. EIJKMAN (*Arch. Path. Anat. Physiol. [Virchow], 9 (1897), No. 1, pp. 187-194; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 18-19, pp. 502, 503*).—In Java a disease which resembles human beri-beri occurs in rice-fed poultry. It is concluded from feeding experiments that some substance occurs in the so-called silver husk of rice that neutralizes the effect of feeding rice to hens.

Studies in immunization against Staphylococcus pyogenes aureus, REICHENBACH (*Beitr. Klin. Chirurgie, 18, No. 1; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 22-23, pp. 712, 713*).

Protective inoculation (*Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20-21, pp. 621-630*).—A review of fourteen papers on the use of tuberculin and on analogous agents in other diseases.

Parasitological notes, M. STOSSICH (*Bol. Soc. Adriat. Sc. Nat., 18 (1897), pp. 1-10, pls. 2; abs. in Zool. Centbl., 5 (1898), No. 4, p. 124*).—New hosts are noted for *Ascaris megalocephala* and other parasites.

On the occurrence of scarlet fever in animals, R. BEHLA (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 20-21, pp. 777-782*).

Contribution to the etiology of typhoid affections in the horse, G. P. PIANA and B. GALLI-VALERIO (*Moderno Zooiatro, 1897; abs. Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20-21, p. 615*).

On anthrax of the lungs, M. W. PETROFF (*Russ. Archiv. Path. Klin. Med. u. Bakt., 3 (1897), No. 6, p. 565; abs. in Centbl. Bakt. u. Par., 1. Abt., 23 (1898), No. 5-6, p. 219*).—A case of anthrax in a brush maker is described in detail. The person died within six days. Plenty of evidence was found to show that the germs entered through the respiratory passages. The bacillus was also found in the peri-bronchial and subpleural lymph vessels, in the lymph glands, and in the kidneys and spleen.

Tuberculin investigations at Hamra (Sweden), O. SVENSTRÖM (*Tidskr. Landtmän, 18 (1897), No. 46, pp. 825-828*).—Experiments were made on the application of tuberculin inoculations as a preventive against tuberculosis. It was found that tuberculin is of no benefit for this purpose, and that by making repeated tuberculin injections on healthy animals no reaction may be obtained if the animals are exposed to contagion and after some time again tested with tuberculin. Animals should not therefore be injected too often with tuberculin, viz, not to exceed twice a year. It is furthermore noted that tuberculin will finally fail to give a reaction with animals which have reacted once or several times.—F. W. WOLL.

Bacteriological study on the transmission of Bacillus anthracis from the mother to the fœtus, C. MASSA (*Prif. Med., 1896, pp. 120, 121; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 22-23, p. 704*).—Twenty-five animals, representing dogs, guineas, mice, and cats, and 113 fœti were studied. The conclusions drawn are: The transmission of micro-organisms to the fœtus can take place only through placental

lesions. The placenta in charbon changes rapidly after death, undergoing a peculiar decomposition, no bacilli occur, and the dead fœtus does not always contain bacilli. These are found only in the blood and in the surrounding amniotic fluid.

New discoveries on Bacillus tuberculosis, its transformation in the common saprophyte, and its resemblance to the Coli bacillus, J. FERRÁN (*Nouvelles découvertes sur le bacille de la tuberculose; La transformation en saprophyte vulgaire et son rapprochement du genera Coli bacilli. Barcelona, 1897; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 16-17, pp. 483, 484*).

Tuberculosis in cattle, E. A. A. GRANGE (*Michigan Sta. Rpt. 1896, pp. 402-412*).—A reprint of Bulletin 133 of the station (E. S. R., 8, p. 625).

An investigation of tuberculosis in the ass, JULME (*Ztschr. Tiermed., 1 (1897), p. 361; abs. in Bakt. u. Par., 1. Abt., 22 (1897), No. 20-21, p. 614*).—It was found that the ass is by no means immune to tuberculosis.

A rare case of udder tuberculosis, EHRHARDT (*Schweiz. Arch. Tierheilk., 1896, pt. 2; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20-21, pp. 613, 614*).—In a healthy cow that two months previous to slaughtering had been diagnosed as affected with tuberculosis of the udder there was found evidence of old lesions in the udder and of fresh miliary tuberculosis in the lungs.

Investigations of bovine tuberculosis in Finland, 1894-95, C. AHLMAN and H. SAWELA (*Landtbr. Styr. Meddel., 1897, No. 20, pp. 167-189*).

The contest against bovine tuberculosis, B. BANG (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 209-229*).

Life history of trichina, J. W. GRAHAM (*Arch. Mikros. Anat., 50 (1897), pp. 219-275, pls. 3; abst. Jour. Roy. Micros. Soc. [London], 1898, No. 3, p. 79*).—The fact that young trichina occur in the body cavity free in the tissue and are unequally distributed in the different groups of muscles the author holds is not supported by the idea of active migration, while the fact that embryos occur in the blood, that the embryo has been found in the artery of the diaphragm, that embryos occur in blood clots in the lungs, and the existence of lesions and the bleeding of capillaries, and the rapidity of distribution are arguments in favor of the distribution of the parasite being by means of the blood vessels.

Filaria and Spiroptera, M. STOSSICH (*Bol. Soc. Adriat. Sci. Nat., 18 (1897), pp. 13-162; abs. in Zool. Centbl., 5 (1898), No. 4, p. 124*).—A monograph treating of 317 species of parasites belonging to the genera Filaria, Spiroptera, Oxyspirura, Filaroides, Spiroxys, and Gongylonema.

The duration of immunity after illness with foot-and-mouth disease, RENNER (*Berlin Tierärzlt. Wchnschr., 27 (1897); abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20-21, p. 621*).—A half year after the disease affected a herd of cattle it appeared again. The animals that had been affected in the first attack escaped the second.

The struggle with foot-and-mouth disease, HOENE (*Berlin Tierärzlt. Wchnschr., 27 (1897); abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 20-21, p. 621*).

Observations on the etiology of foot-and-mouth disease, V. BABES and G. PROCA (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22-23, pp. 835-849, figs. 5*).—The author found several bacterial forms and believes that he has isolated one, a fungoid-bacterioid, that is the cause of the disease. This form is of uncertain position, but it calls to mind Babes's *Ascobacterium lutem*. Injection of cultures produced the fever.

The causes and importance of udder diseases, J. WENNERHOLM (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 160-173*).

A case of three-fold infection, L. GUSSEW (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 22-23, pp. 849-857, fig. 1*).—Infection with Bacillus of charbon, a pus-forming Streptococcus, and Fraenkel's Diplococcus.

The origin of tetanus antitoxin in the animal body and its relation to tetanus poison, A. KNORR (*Fortschr. Med., 1897, No. 17; abs. in Centbl. Bakt. u. Par., 1. Abt., 22 (1897), No. 18-19, pp. 567-568*).

Topographical anatomy of the horse, W. ELLENBERGER and H. BAUM (*Topographische-Anatomie des Pferdes. Berlin: Paul Parey, 1897, 3 vols., pp. 951; rev. in Nature, 56 (1897), No. 1460, p. 586*).

TECHNOLOGY.

Paints and painting materials and miscellaneous analyses, H. H. HARRINGTON and P. S. TILSON (*Texas Sta. Bul. 44, pp. 961–973*).—Tests of the drying properties of crude and refined cotton-seed oil and analyses of thirteen samples of commercial paints are reported. The conclusion is drawn that cotton-seed oil may be used for rough outside painting in summer weather, especially if mixed with a dryer, but in no case will it give the luster or hardness which may be obtained with linseed oil. "Its durability may, however, be even better." It is recommended to buy the oil and pigments separately and mix them to suit, rather than to buy the ready mixed paints.

Analyses of 36 samples of mineral waters, 2 of damaged cotton-seed meal, 6 of coal, 4 of copper ore, 2 of iron ore, 2 of clay, 1 of fertilizer, 1 of calcareous shells, 2 of asphalt, 2 of ashes, and 2 of satol (whole plant and inner portion), and the results of an examination of 2 distillation by-products from lignite tar are also reported.

Notes on cold storage, F. W. RANE (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 53–59*).—This is a general discussion of the use of cold storage for the preservation of agricultural products of various kinds, including an account of a cold-storage cellar constructed at the New Hampshire Station in which apples and potatoes were successfully stored. The principle upon which this storage cellar was constructed is thus explained:

"It might be termed climate cold storage, and consists of studying and husbanding the lowest temperatures of one's climate to do one's bidding. There are few days at a stretch from September until late in spring in New England, for instance, but that the temperature falls at some time sufficiently to utilize it for cold storage. Being prepared to retain this temperature in cellars or buildings constructed for the purpose until a similar or lower temperature is again realized is the key to its success. From experience it is believed this simple method can with comparatively little care and expense be made more useful at present (in this our transitory stage) than all others. It is not offered to take the place of other systems already mentioned, but to meet an apparent need in our rural districts."

Wool scouring, E. F. LADD (*North Dakota Sta. Bul. 32, p. 271*).—The losses in weight from scouring three samples of wool were 60.01 per cent, 62.64 per cent, and 61.77 per cent. It is stated that these were "fair samples from the sheep as found on the prairies in the sheep belt of the western part of the State. . . . Data that have come under the observation of the writer have shown a loss of from 55 to 70 per cent from scouring samples of North Dakota wool."

On the natural occurrence of large amounts of potassium chlorid and sodium chlorid in the juice of grapes and in the wines of the saline regions of Oran, E. BONJEAN (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 18, pp. 1275–1277*).—The French law requires that wine shall not contain more than 0.607 gm. of chlorin per liter. The author found more than this in grapes of the province of Oran and in the wine made from these grapes.

A study of some bad wines, E. KAYSER and G. BARBA (*Ann. Sci. Agron., 1898, 1, No. 1, pp. 25–39*).

Castor oil manufacture (*Producers' Gaz. and Settlers' Record [Western Australia], 5 (1898), No. 2, p. 127*).—A short note on the method of extracting the oil.

AGRICULTURAL ENGINEERING.

Progress in timber physics, B. E. FERNOW (*U. S. Dept. Agr., Division of Forestry Circ. 18, pp 20, dgms. 11, tables 10*).—The influence of size on test results and distribution of moisture as factors in timber physics are reported upon at some length. The circular also contains some notes by S. T. Neely on the "Endwise-compression strength to breaking load of beams." The most important conclusions given in the circular are as follows:

"A difference in strength values derived from a few specimens of the same kind of wood, up to 10 per cent for coniferous wood and to 15 per cent for hard woods, can not be considered a difference of practical importance; such differences can not be relied upon as furnishing a criterion of the quality of the material.

"The size of the test piece does not in itself influence strength values (except in compression endwise when the size is less than a cube).

"Small test pieces judiciously selected furnish a better statement of average values of a species than tests on large beams and columns in small numbers.

"A large series of tests on small pieces will give practically the same result as such a series on large beams and columns; hence, there is no need of finding a coefficient with which to relate the results of the former to construction members.

"The influence of moisture on strength appears even greater than the former tests and statements from this Division have indicated."

The most important discovery of all is that worked out by S. T. Neely, as follows:

"The strength of beams at elastic limit is equal to the strength of the material in compression, and the strength of beams at rupture can, it appears, be directly calculated from the compression strength; the relation of compression strength to the breaking load of a beam is capable of mathematical expression."

Dynamometer tests on farm wagons, C. D. SMITH (*Michigan Sta. Rpt. 1896, p. 110*).—"On good roads the draft of wide and narrow tired wagons was about equal. On plowed land a narrow tired wagon pulled 45 per cent harder than one with wide tires; on a road with sand 2 in. deep, 25 per cent harder; and on sod, 16 per cent harder. A wagon not greased pulled 18 per cent harder than one greased."

Shrinkage of cord wood, C. D. SMITH (*Michigan Sta. Rpt. 1896, pp. 110, 111*).—Five cords of freshly cut, 18-in. green beech wood weighed 14,336 lbs. on February 7. The wood was piled out of doors, and on October 9 it weighed 7,148 lbs. "Twenty cords of 18-in. slab wood split into stove wood gained 10 per cent in bulk in the operation."

Drainage by means of fascines, R. SCHMOLDT (*Deut. Landw. Presse, 25 (1898), No. 24, p. 262*).

Windmills, M. RINGELMANN (*Jour. Agr. Prat., 62 (1898), I, No. 21, pp. 761, 762*).

Irrigation on our farm, R. HITTINGER (*Agr. of Massachusetts, 1897, pp. 111, 112, fig. 1*).—An account is given of the irrigation of a farm and greenhouses from two artesian wells, the water being raised by a windmill and a steam pump and applied through pipes and revolving sprinklers.

Irrigation in Utah, C. H. BROUGH (*Baltimore: The Johns Hopkins Press, 1898, pp. XV+212, pls. 4*).—The book is divided into two parts, (1) economic history of irrigation in Utah, including the formation of the cooperative system (1847–48), economic development under the cooperative system (1848–1862), early legislation (1862–1867), transportation and commerce as aids to irrigation (1867–1877), recent legislation (1877–1897), capitalistic irrigation (1890–1895), development of agriculture through irrigation, development of horticulture through irrigation, and relation of irrigation to other factors of Utah's industrial system; (2) problems of irrigation in Utah, including advantages of reclaiming the remaining irrigable land, methods of reclaiming the whole body of irrigable land, administration of irrigable land already ceded to the State, State control of water, necessity for more accurate means of measuring water, and marketing of irrigation products. Miscellaneous information and data are given in an appendix.

Sewage disposal, B. F. LA RUE (*Sci. Amer. Sup., 45 (1898), No. 1171, p. 18743, fig. 1*).—Different methods of sewage disposal are discussed, broad irrigation being considered "the most satisfactory and effectual means of sewage purification yet tried where suitable land can be procured."

Notes on the employment of convicts in connection with road building, R. STONE (*U. S. Dept. Agr., Office of Road Inquiry Bul. 16, rev., pp. 21, figs. 4*).—A reprint of Bulletin 16 of the Office of Road Inquiry of this Department (E. S. R., 7, p. 258), with some additional matter on the subject supplied by various officers in South Carolina, California, and New York.

Swine pasture fences, S. M. EMERY (*Montana Sta. Bul. 14, p. 34*).—Barbed wire fences for pig pastures at the station have proved unsatisfactory, and board fences are objectionable because of their expense and tendency to collect snow drifts. The author recommends the use of woven wire for the purpose.

Building silos, C. D. SMITH (*Michigan Sta. Spec. Bul. 6, pp. 17, figs. 10*).—General considerations in the construction of silos are discussed and methods of construction of stave silos, round silos with horizontal lining, and rectangular and square silos are explained, with plans and specifications.

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Kansas Station, 1897 (*Kansas Sta. Rpt. 1897, pp. XX*).—This contains the financial report for the fiscal year ending June 30, 1897, and the report of the council giving an outline of Bulletins 65 to 71 published by the station during the year and an account of the work in progress of the different departments The station staff was changed September 1, 1897, and shows an almost complete reorganization.

Ninth Annual Report of Michigan Station, 1896 (*Michigan Sta. Rpt. 1896, pp. 93–469*).—A financial statement for the fiscal year ending June 30, 1896; short reports by the director and heads of departments, including detailed reports of the apiarist, meteorologist, horticulturist, agriculturist, and botanist (noted elsewhere) on the work of the year, and reprints of Bulletins 125 to 134 of the station.

Tenth Annual Report of Tennessee Station, 1897 (*Tennessee Sta. Rpt. 1897, pp. 152–165*).—Contains the report of the treasurer for the fiscal year ending June 30, 1897, brief reports by the heads of the various departments on the work of the year, a general review of the work of the station by the secretary, and a list of the publications of the station since its organization in 1888.

Historical Sketch of the United States Department of Agriculture; its objects and present organization, C. H. GREATHOUSE and G. W. HILL (*U. S. Dept. Agr., Division of Publications Bul. 3, pp. 74, pls. 3, figs. 10*) —This sketch is compiled from the annual reports of the several Commissioners and Secretaries of Agriculture and deals with the history, work, and growth of the Department under the different administrations since its organization. It is "supplemented with a statement of the origin and duties of the several bureaus, divisions, and offices of the Depart-

ment . . . and by citations from the several laws under which the Department has attained its present state of development."

Of what service are statistics to the farmer? J. Hyde (*U. S. Dept. Agr., Division of Statistics Bul. 14, misc. ser., pp. 258–270*).—A popular discussion of the value of statistical information to agricultural interests. (Reprinted from the Yearbook of the Department of Agriculture for 1897, pp. 258–270.)

Experiment station work—IV (*U. S. Dept. Agr., Farmers' Bul. 73, pp. 31, figs. 3*).—This is the fourth number of this series of popular bulletins based upon experiment station work in this and foreign countries. The following subjects are discussed: Pure water, loss of soil fertility, availability of fertilizers, seed selection, Jerusalem artichoke, Kafir corn, thinning fruit, use of low-grade apples, cooking vegetables, condimental feeding stuffs, steer and heifer beef, and swells in canned vegetables.

Trade of Porto Rico, F. H. Hitchcock (*U. S. Dept. Agr., Section of Foreign Markets Bul. 13, pp. 84*).—A statistical review of the foreign trade of Porto Rico, showing the nature, amount, and value of the principal imports and exports, the countries with which most of the trade is carried on, etc., for each of the ten years ending with 1896. The total export trade of Porto Rico in 1896 amounted to $18,311,130 and the total import trade to $18,282,690. The principal exports of Porto Rico are sugar and coffee. These constitute fully 85 per cent of all agricultural merchandise sent from the island to foreign markets. More than 99 per cent of the coffee is sent to Spain, Cuba, and France, and less than 1 per cent to the United States. Out of 122,946,335 pounds of sugar exported from Porto Rico in 1896, 71,875,614 pounds were sent to the United States. Spain received the next largest amount, 43,600,064 pounds. The principal imports of Porto Rico are rice, wheat flour, and hog products. The two latter are obtained principally from the United States and the former from the British East Indies and through German and Spanish sources.

Crop circulars for May and June, 1898 (*U. S. Dept. Agr., Division of Statistics Crop Circ. May, pp. 3; June, pp. 4*).—The circular for May is the first of a series of crop circulars designed to take the place of the new series crop reports heretofore issued. It gives the acreage and condition of wheat, rye, cotton, meadows, and spring pasture, and notes the progress of spring plowing in the different States and Territories up to the first day of May. The June circular extends this information to June 1 and contains in addition a compiled summary of climatic conditions during the spring months of 1898.

Report on crops, live stock, etc., in Manitoba, 1898 (*Ontario Dept. Agr. and Immigr. Bul. 55, pp. 19*).—Information relative to acreage and condition of the crops, live stock, etc., the rainfall, and other climatic conditions, compiled from the reports of about 350 correspondents. A list of the creameries and cheese factories in Manitoba, with the name and address of secretary of each, is included in the report.

Crops and live stock in Ontario (*Ontario Bureau Ind. Bul. 65, pp. 8*).—A report on the rainfall and temperature of the winter months and on the status of fall wheat, clover, vegetation, live stock, farm supplies, etc., with remarks of correspondents, and farm statistics for Manitoba for 1897.

The development of agriculture in Ontario, C. C. James (*Ontario Bureau Ind. Rpt. 1896, App., pp. 24–48*).—A semi-statistical paper dealing with the history and progress of agriculture in Ontario.

Brief review of the activity of the Ministry of Agriculture and Government Estates during the second year of its existence, March 30, 1895–March 30. 1896 (*St. Petersburg, 1896, pp. 234, V; abs. in Selsk. Khoz. i Lyesor., 185 (1897), May, pp 481, 482*).—Among the features of the work were the following: Seven new lower agricultural schools were opened. In the agricultural school at Charkov a new department has been established for the study of the methods of teaching agricultural subjects and applied natural sciences. In 42 places courses in agriculture have been introduced for the teachers in public schools. The number of instructors in dairying has been increased and the sphere of their activity widened. Of the work in

separate branches of agriculture may be mentioned the efforts to introduce improved races of cattle and hogs by buying good stock and selling it to the farmers on easy terms.—P. FIREMAN.

Description of individual Russian farms (*Selsk. Khoz. i Lyesov., 186 (1897), July, pp. 1–71; Aug., pp. 315–376; 187 (1897), Oct., pp. 1–95; Nov., pp. 241–280; Dec., pp. 493–517*).—The Ministry of Agriculture commissioned a number of experts to describe the methods of farming in different localities of Russia by describing individual farms, especially those that present some particular points of interest. The object was twofold: (1) to familiarize the farmers with the successful improvements and innovations, and (2) to spread information as to the places where proper seeds, fruit trees, pure-blooded animals, etc., could be directly obtained without the intervention of middlemen. Through the latter means it was hoped that direct cooperation between agriculturists would be encouraged and confidence in useful innovations increased.—P. FIREMAN.

Review of the activity of the Ministry of Agriculture and Government Estates for the third year of its existence, March 30, 1896–March 30, 1897 (*St. Petersburg, 1897, pp. VI, 389; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Oct. p. 231*). Among the most important work accomplished during this period was the solution in a legislative way of the questions of granting loans for agricultural improvements and of providing the peasants with land in four Siberian governments—Tobolsk, Tomsk, Yeniseisk, and Irkoutsk. Of the measures which are proposed especial stress is laid on the spreading agricultural information, in part among women, by establishing corresponding secondary and lower schools.—P. FIREMAN.

Agricultural holdings in Germany (*Jour. Bd. Agr. [London], 5, No. 1, pp. 29–35*).—Size and modes of tenure of agricultural land in Germany and a comparison with the holdings in Great Britain.

Finnish agriculture, N. GROTENFELT (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 240–256*).

Catalogue of reports and bulletins of New Jersey Stations and index of reports, 1880–1897 (*New Jersey Stas. Spec. Bul. R, pp. 44*).

Accessions to the Department library, January–March, 1898 (*U. S. Dept. Agr., Library Bul. Apr., 1898, pp. 33*).

The promotion of agricultural science, I. P. ROBERTS (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 82–85*).—Suggestions as to methods of making information in agricultural science available to the rural population of the country.

Agricultural association in the Scandinavian countries, P. FAHLBECK, G. TANDBERG, and J. C. LA COUR (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 490–518; II, App. 15, pp. 15*).

Report of the Chemical and Seed Control Station at Aabo, Finland, 1895 (*Landtbr. Styr. Meddel, 1897, No. 19, pp. 139, 140*).

Agricultural counselors in the Scandinavian countries, J. NATHORST (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 51–72*).

Agricultural education in Spain (*Jour. Bd. Agr. [London], 5, No. 1, p. 79*).—A short note giving a general description of agricultural education in Spain. The annual expenditure on agricultural education, including the payment of agricultural engineers, experts, foremen, etc., is a little over $280,000.

Report on agricultural education in Denmark, M. HEY (*Bul. [Min. Agr. France], 16 (1897), No. 1, pp. 147–168*).—A description of the system of agricultural education in Denmark.

Technical instruction for farm women, H. TVETER (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 282–286; II, App. 7, pp. 14*).

Agricultural institutions in Denmark, N. HEYMAN (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 207–209*).

Bird day in the schools, T. S. PALMER (*U. S. Dept. Agr., Biological Survey Circ. 17, pp. 4*).—A popular circular designed to awaken an interest in birds and establish a day on which special attention will be given to birds in schools, etc.

NOTES.

ARIZONA STATION.—C. S. Parsons has been appointed director and irrigation engineer of the station, to succeed J. W. Toumey, who has been acting director since November 1, 1897. Professor Toumey will confine himself to botany and entomology. S. M. Woodward has been appointed meteorologist of the station, to succeed N. H. Barnes, resigned.

FLORIDA STATION.—At the annual meeting of the board of control, held June 14, it was voted to build an experimental tobacco-curing barn and laboratory. The plans adopted include two curing or drying rooms, provided with artificial heat; a sweat room, and a bacteriological laboratory. The entire process of curing the crop, including all the stages from the field to the rolling of the cigar, are to be scientifically studied, with a view to discovering the causes of the changes taking place and to studying the possibility of controlling these changes and producing them at will. This laboratory is believed to be the only one in existence devoted to this work.

GEORGIA COLLEGE AND STATION.—H. N. Starnes has resigned his position as horticulturist of the station, to take effect January 1, 1899, and has been elected professor of agriculture and horticulture in the college. A. L. Quaintance, assistant biologist of the Florida Experiment Station, has been elected to fill the vacancy caused by Professor Starnes's resignation.

INDIANA STATION.—A. H. Bryan has been elected assistant chemist of the station.

IOWA COLLEGE AND STATION.—The following changes have been made in the board of trustees: Governor L. M. Shaw, and R. C. Barret, superintendent of public instruction, have become members *ex officio*, and S. H. Watkins, of Libertyville; C. S. Barclay, of West Liberty, and W. B. Penick, of Tingley, have been appointed in place of C. M. Dunbar, Hamilton Smith, and A. B. Shaw. The following additions have been made to the station staff: Joseph J. Edgerton, assistant in agricultural physics; F. W. Bouska, assistant in dairying; and Miss C. M. King, entomological and botanical artist.

A sheep barn, 32 by 40 ft., with wings 16 by 100 ft., is being built. The leading lines of railway are arranging to cooperate in running excursions to the station and college at a very low rate.

The dairy department is now furnishing the U. S. Department of Agriculture with 1,000 lbs. of butter a week for export to foreign markets. An extensive farm implement storage room is now being constructed, which will facilitate the work of instruction in agricultural physics.

NEBRASKA UNIVERSITY AND STATION.—The board of regents at their June meeting established a department of animal husbandry, to be in charge of C. H. Elmendorf. Vergil C. Barber, A. B., of the university, was appointed assistant to Dr. Peters in the department of animal pathology. R. A. Emerson, B. Sc. of the Office of Experiment Stations, was appointed assistant professor of horticulture, to succeed F. W. Card, resigned, the appointment to take effect April 1, 1899.

NEW YORK CORNELL STATION.—Wilhelm Miller has been appointed assistant in horticultural work and has charge of experiments with chrysanthemums.

OREGON STATION.—B. L. Pague, of Portland, has been elected a member of the board of regents, *vice* Samuel Hughes, deceased.

TEXAS COLLEGE AND STATION.—At the annual meeting of the board of directors L. L. McGinnis, of Bryan, was elected treasurer, *vice* L. L. Foster.

The first Farmers' Congress was held at the college July 13–15. In connection with this congress meetings were held of the Texas State Horticultural Society, the State Swine Breeders' Association, and the State Dairymen's Association. The congress was well attended and successful in every way.

WYOMING UNIVERSITY AND STATION.—E. E. Smiley has been elected president of the university and director of the station, *vice* F. P. Graves, who has resigned, to accept the presidency of the University of Washington.

STATION FOR PLANT PROTECTION AT HAMBURG, GERMANY.—A station for plant protection has been established at Freihafen, near Hamburg. Dr. C. Brick, of the Botanical Museum of Hamburg, has been appointed director of the station and Dr. L. Reh, zoologist. The establishment of the station grew out of the discussion of the danger of the introduction of the San José scale by means of American fruits. It will also be the duty of the station to control the importation of live plants from foreign countries, investigate means of repression in the case of outbreaks of plant diseases, and exercise control over the great nurseries, vineyards, and fruit orchards in the region.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director.*

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers (including methods of analysis), Soils, and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
F. C. KENYON, PH. D.—Entomology and Veterinary Science.
R. A. EMERSON—Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 3.

In the appropriation act for this Department for the current fiscal year ten thousand dollars was provided by Congress "for the purpose of collecting from agricultural colleges, agricultural experiment stations, and other sources, including the employment of practical agents, valuable information and data on the subject of irrigation, and publishing the same in bulletin form." The general supervision of this work has been assigned to the Director of this Office. It was decided that the best way in which the Office could get the advice which it needed for the formulation of plans of work along the most useful lines was to call a conference in the irrigated region of experiment station officers and irrigation engineers who had been most largely engaged in recent years in making experimental inquiries in irrigation, or in dealing with the administrative and practical problems involved in the use of water for irrigation in the West. This conference was held at Denver, July 12 and 13, 1898, and was attended by experiment station officers from California, Nebraska, Colorado, Utah, Montana, and Wyoming, and the State engineers of Wyoming and Colorado.

After careful consideration it has been determined to confine the work on irrigation for the present to two general lines: (1) The collation and publication of information regarding the laws and institutions of the irrigated region in their relation to agriculture, and (2) the publication of available information regarding the use of irrigation waters in agriculture as shown by actual experience of farmers and by experimental investigations, and the encouragement of further investigations in this line by the experiment stations.

The proposed investigation of the actual amounts of water used by successful farmers in different parts of the irrigated region on different soils and in the growing of different crops is believed to be a fundamental inquiry. If sufficient funds are provided for its accomplishment on an adequate scale, it will furnish the basis not only for just court decisions and the equitable apportionment of water by administrative officers, but also for the more systematic and scientific inquiries with a view to the determination of the minimum amounts of water required for successful agriculture under different conditions, and the maximum area which can be properly irrigated in any given locality.

This investigation should be planned and prosecuted in a manner which its importance demands. The work should be begun at once and pushed rapidly to completion. Every year's delay in this undertaking makes the task of a proper settlement of the great water problems of the semiarid region more difficult and perplexing.

The experiment stations are already conducting considerable useful work on problems relating to irrigation farming. They need, however, in several States to concentrate their energies and funds more fully on these problems. And in the larger enterprises they might well have the aid of this Department if means were provided by Congress for this purpose.

We have received the regulations and syllabus of the School of Agriculture, Ghizeh, Egypt, as approved by the minister of public instruction August 14, 1898. From this document we learn that the course of study extends over four years and includes practical and theoretical agriculture, agricultural chemistry, natural science, theoretical and practical chemistry, farm bookkeeping, land surveying, hydraulics, veterinary science, physics, arithmetic, algebra and geometry, trigonometry, Arabic language, and English language. Eight hours a week throughout the course are given to practical exercises in agriculture. Each pupil is allotted a plat of land which he must cultivate with his own hands, "the employment of hired labor or other assistance being absolutely prohibited." This plat consists of one-quarter of a feddan (1.038 acres) the first year, half a feddan the second year, and three-fourths the third and fourth years. "Every pupil shall be allowed to dispose of the produce of his plat, subject to the approval of the principal."

To be admitted to the school the pupils must be at least 14 years of age and must pass an entrance examination. The annual fees for tuition and other expenses are £15 for day pupils and £25 for boarders. The fee for day pupils covers the cost of a mid-day meal provided at the school. Pupils may be admitted to the school free of charge, at the discretion of the minister, provided they are in needy circumstances.

The instruction in theoretical agriculture includes such subjects as soils, climate, tillage, manuring, the feeding and breeding of farm animals, dairying, culture of different crops, construction and sanitation of farm buildings, and agricultural implements. Special attention is given to irrigation and the culture of crops especially suited to local conditions, among which are rice, cotton, sugar cane, berseem (Egyptian clover, *Trifolium alexandrinum*), beans, wheat, barley, maize, peanuts, flax, potatoes, sesame, indigo, fenugreek, chick-peas, and alfalfa. Sugar making and the extraction of cotton-seed oil and indigo are also taught. A special topic is the treatment of the salt lands in upper and lower Egypt, including washing, reclaiming, and cropping.

PHYSICAL AND METEOROLOGICAL RESEARCHES, PRINCIPALLY ON SOLAR RAYS, MADE AT THE STATION OF AGRICULTURAL CLIMATOLOGY AT THE OBSERVATORY OF JUVISY.[1]

CAMILLE FLAMMARION,

Director of the Station.

THE SUN AND THE TEMPERATURE.

There appears to be a very curious relation between the annual temperature and the variation of the sun spots, which seems to indicate a certain correlation between the two phenomena. It is known that in the manifestation of its activity the sun exhibits a certain periodicity; there are dark spots, faculæ or illuminated spots, and eruptions. This period is about 11 years. The last maximum occurred in 1893 and corresponded with the maximum temperature, not only in France, but in many other parts of Europe. The last minimum occurred from 1887 to 1890. This corresponded with a series of cold years. Below is given the extent of the spotted solar surface in millionths of the visible solar hemisphere, calculated from data collected at Greenwich, Dehra-Doon (India), and the island of Mauritius, and the average temperatures of each year in Paris.

Relation between sun spots and temperature.

Year.	Aver. annual temperature.	Extent of sun spots.	Year.	Aver. annual temperature.	Extent of sun spots.
	Deg. C.			*Deg. C.*	
1878	10.0	22	1888	8.9	89
1879	8.2	45	1889	9.5	78
1880	10.6	408	1890	9.3	99
1881	9.8	740	1891	9.5	569
1882	10.2	1,002	1892	10.2	1,214
1883	9.9	1,155	1893	10.8	1,464
1884	10.5	1,079	1894	10.4	1,282
1885	9.8	811	1895	9.9	974
1886	10.3	381	1896	9.8	530
1887	8.8	178			

The data are shown graphically in fig. 5 (see p. 204).

By adding the years by couplets the effects of local disturbances and

[1] Continued from page 114.

the great irregularities of temperature will be equalized. Taking the

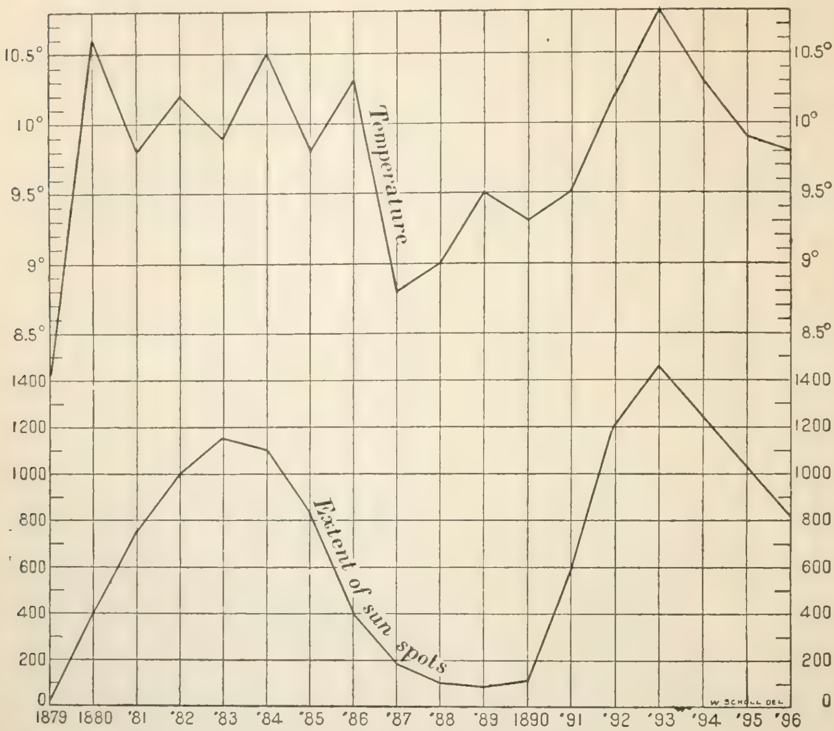

FIG. 5.—Relation between annual temperature and sun spots.

average of each couplet, the following figures will be obtained in regard to temperature and sun spots:

Relation between sun spots and temperature.

Year.	Temperature.	Sun spots.	Year.	Temperature.	Sun spots.
	Deg. C.			*Deg. C.*	
1878–79	9.1	34	1887–88	8.9	133
1879–80	9.4	227	1888–89	9.2	83
1880–81	10.2	574	1889–90	9.4	88
1881–82	10.0	871	1890–91	9.4	334
1882–83	10.0	1,078	1891–92	9.9	892
1883–84	10.2	1,117	1892–93	10.5	1,339
1884–85	10.2	945	1893–94	10.6	1,407
1885–86	10.1	596	1894–95	10.2	1,128
1886–87	9.6	279	1895–96	9.9	752

If these figures are represented graphically they will give the diagram in fig. 6. This data is submitted without comment to the judgment of astronomers and meteorologists. Observations at Brussels, London, Edinburgh, Berlin, Prague, Lyons, Bordeaux, Toulouse, Arles, Marseilles, Perpignan, and Montpellier agree with the results at Paris, while other European stations show contradictory results. The sun

spots, the faculæ, and the eruptions are certainly an indication of a greater activity of the sun. It is not surprising, then, if the epochs of the maximum correspond with years of higher temperature. An increase of heat may, however, produce cold; for instance, the melting

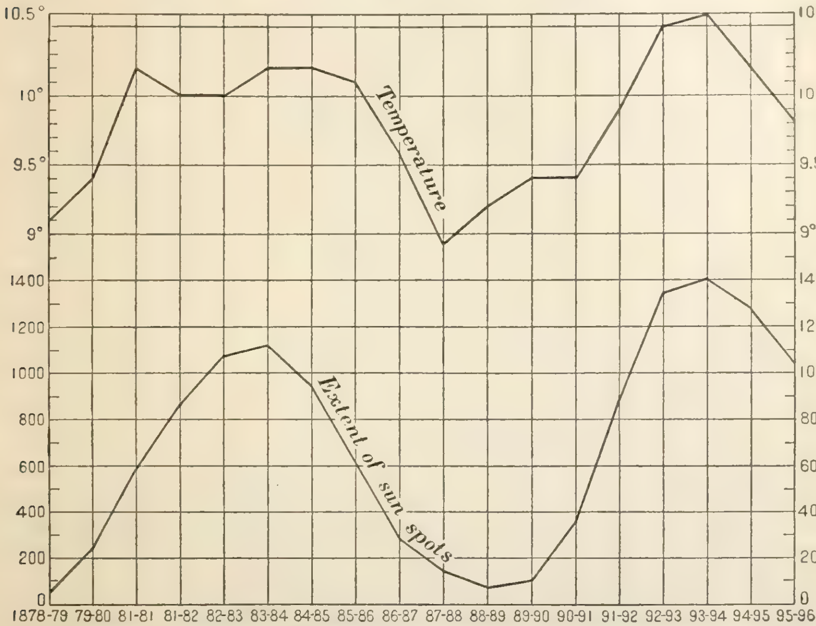

FIG. 6.—Relation between temperature and sun spots, using 2-year averages.

of ice in the polar regions, resulting in the detaching of icebergs by causing cold currents in the sea, will produce a low temperature in some region.

STUDY OF THE SOLAR RADIATION.

It is possible, by means of proper apparatus, to measure the caloric and luminous radiations of the sun. This can be effected either by allowing the radiations to act together or by separating and distinguishing their relative actions. The apparatus at the station consisted of a Violle actinometric register, a brilliant gilded and black combined thermometer, two vaporizing actinometers, a sunshine register, an horal photometer, and a Cooke radiometer. A record made in 1896 showed the following amounts of heat, by months:

Total amount of heat at Juvisy during 1896.

Month.	Calories.	Month.	Calories.
January	2,582	August	11,918
February	6,467	September	9,368
March	9,862	October	5,477
April	11,776	November	3,576
May	18,606	December	2,034
June	14,778		
July	15,393	Total	111,837

The year 1895 gave 144,411 calories. By means of silver-print paper, which is more sensitive than the paper prepared with prussiate of iron, the number of hours of sunshine are registered. The following table shows the total number of hours of sunshine and the theoretical number—i. e., the number of hours between sunrise and sunset:

Hours of sunshine at Juvisy in 1896.

Month.	Actual.	Theoretical.	Month.	Actual.	Theoretical.
January	15.07	268.04	August	122.50	436.48
February	77.40	280.40	September	120.30	371.28
March	92.23	364.30	October	90.35	328.38
April	126.30	407.52	November	55.40	269.16
May	269.00	468.29	December	25.00	251.35
June	191.15	476.25			
July	212.05	478.57	Total	1,398.35	4,402.72

The proportion of hours of actual sunshine was but 32 per cent. The greatest amount of sunshine occurred during May and the least during January and December. In 1895 the register showed 1,817.15 hours of sunshine.

TEMPERATURE OF THE AIR.

The temperature of the air in the shade was observed and registered daily by means of a standard thermometer and with maximum and minimum thermometers.

Average temperature of the air at Juvisy during 1896.

Month.	Average for 24 hours.	Average of maximum and minimum.	Remarks.
	Deg. C.	Deg. C.	
January	2.68	2.76	Mild.
February	2.65	2.82	Cold.
March	8.36	8.60	Warm.
April	9.39	9.97	Normal.
May	13.01	12.62	Do.
June	17.48	17.50	Warm.
July	19.20	18.80	Very warm.
August	15.82	15.91	Cold.
September	14.42	15.00	Fresh and rainy.
October	8.34	8.82	Do.
November	2.82	3.13	Cold.
December	3.50	3.74	Mild.
Average	9.80	9.98	

If the average of 365 days of the year be taken, the annual temperature will be 9.84° instead of 9.80°. In 1896 January was very warm, 0.7° above the normal. February was very dry and relatively cold, 1° below the normal. In conclusion, the winter was warm and the rainfall much less than normal. Spring was warm and dry. During May the rainfall at Juvisy was only 3.2 mm., the smallest rainfall during May for a century, except May 1880, when a lighter rainfall, 1 mm., was recorded, with the same temperature. The drought was extreme almost all over France and the harvest was threatened. During June

heavy rains revived the meadows and permitted the culture of a middling harvest. Hay was scarce. The temperature was very favorable during the period of growth but the rainfall was deficient. The long drought was followed by a period of rain, storms, and cyclones, which lasted until the end of autumn. These abundant rains retarded the autumn sowing and seriously affected the vintage which had promised so magnificently. Wine was plenty, but of poor quality. The autumn temperature was very cold and considerably lower than normal. Winter and spring until May were warm and dry, the summer almost normal, while autumn was cold and rainy. Comparing the annual temperatures for the last 12 years, it is seen that the years 1887 to 1891 were very cold and 1893 was very warm. Since then the curve has declined. The relation which seems to exist between the temperature and the sun spots has already been pointed out.

TEMPERATURE AT AND BELOW THE SURFACE OF THE SOIL COVERED WITH GRASS.

The temperature of the interior of the soil plays an important part in the phenomena of plant growth. It affects a large number of food plants which are produced under the surface as well as the roots of the trees, which develop at various depths. One of the first duties of the climatological station of Juvisy was the construction of thermometers, registering instruments, etc., to be placed at various depths under the surface of the soil to register the variations in temperature. The temperature was recorded by an apparatus one meter above the soil, which could be read and compared constantly. Five thermometers composed of metallic cylinders filled with spirits of wine were placed at depths of 0.05, 0.10, 0.25, 0.50, and 1 meter, to constantly register the temperature. The comparison of daily curves gives results which are curious as well as important. Thus it can be seen that the amplitude of the curve varies with the depth, being very large at 0.05 and nothing at 1 meter. The following table shows the monthly average temperature observed at the surface of the soil and at different depths in 1896:

Average temperature of soil and air at Juvisy during 1896.

Month.	In the air.	At surface of ground.	Below the surface of the ground.				
			0.05 meter.	0.10 meter.	0.25 meter.	0.50 meter.	1 meter.
	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.
January	2.6	3.4	3.1	2.6	3.2	5.0	6.9
February	2.6	3.7	3.2	3.0	2.9	4.7	6.8
March	8.3	10.2	9.1	8.7	8.6	8.3	8.1
April	9.4	12.7	11.2	10.9	10.5	10.6	11.0
May	13.0	18.1	16.2	15.9	15.5	14.5	14.0
June	17.4	22.0	20.8	20.6	20.5	18.3	16.9
July	19.2	24.4	23.0	22.0	22.2	21.1	19.4
August	15.8	21.3	19.2	19.0	19.7	19.4	19.1
September	14.3	17.8	16.4	15.9	16.5	16.8	17.5
October	8.3	10.8	10.4	10.0	11.2	12.1	14.4
November	2.8	4.9	4.6	4.2	5.5	6.9	9.8
December	3.6	4.1	3.8	3.4	3.7	5.1	7.6
Average	9.80	12.78	11.75	11.35	11.69	11.91	12.61

Figure 7 gives a graphic representation of the temperature at different depths. Temperature affects plants differently according to the depth of their roots. At 0.05 meter, for instance, is given the temperature for the germination of seed. The maximum, and especially the minimum, temperatures are most important. The highest average temperatures in winter were those at a depth of 1 meter, while in summer the highest temperatures were at the surface of the soil and the lowest at a depth of 1 meter. There is an inversion in the spring and in the autumn.

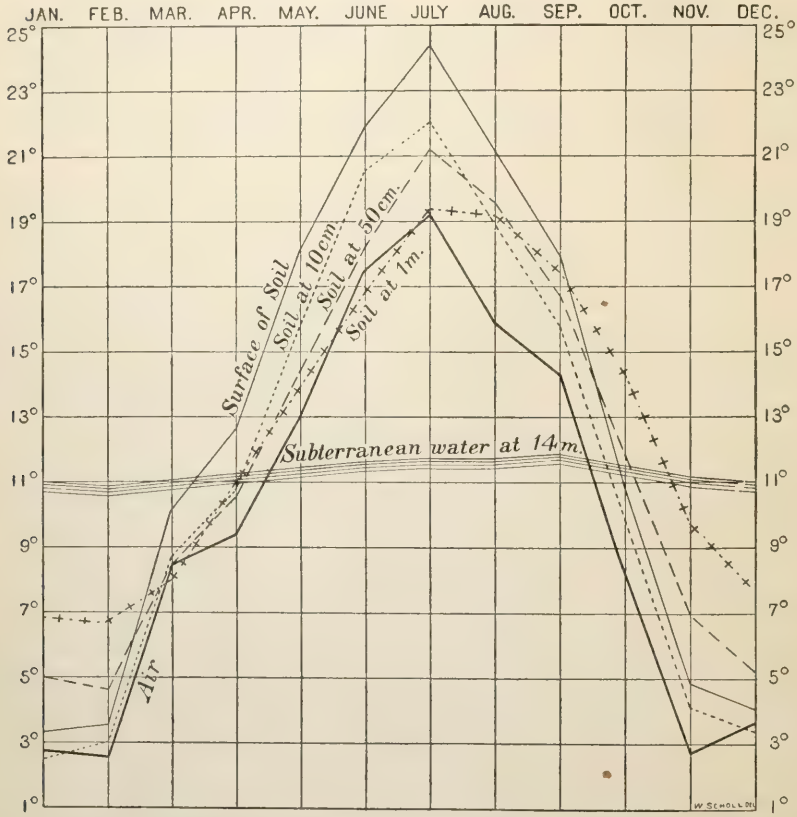

FIG. 7.—Temperature of subterranean water and of the soil at different depths.

On this account the average annual temperature is about the same for all the depths. These phenomena vary somewhat from one year to another, the inversions being produced more or less slowly according to the heating or cooling of the soil. At times this inversion is remarkable, as was the case in the spring of 1896. Sometimes it is very incomplete, as in the winter of 1896. The minimum was observed in February and the highest temperature was attained in July. Hot days completely dry out the superficial layers of the soil, and high temperatures are, unless accompanied by a sufficient rainfall, injurious to plants.

May and June were hot and dry, and plants did not get the necessary moisture. If the average annual temperatures of the soil at different depths are compared, it will be seen that the temperatures diminish from the surface of the soil as far down as 0.10 meter, where it reaches a minimum, from which it rises as far as 1 meter. The increase in temperature is less rapid from 0.10 to 1 meter than the decrease from the surface of the soil to 0.10 meter. This phenomena, which at first might appear abnormal, is easily explained. The sun's heat is transmitted through the soil by conductivity. The heating of the soil is either effected through the contact with the warmer air or by the direct action of the sun's rays. The heat is transmitted to the different depths by warming successively the different layers of the soil. The cooling is effected by contact with the colder air, and also by the radiation. The layers of the soil cool from the surface toward the interior, and there is a certain depth where the temperature reaches a minimum. This depth where the temperature is lowest varies according to the different meteorological conditions during the day. The annual average is 0.10 meter below the surface. Wind, rain, and the condition and the humidity of the soil are factors which influence heat and cold. These agents influence specially the superficial layer of the soil and modify its temperature. It is not possible therefore to state with any precision whether the soil is warmer or colder at this or that depth. The fluctuation of the temperature of the soil at different depths is shown in the following table:

Variation in temperature of soil at different depths.

Date.	In the air.	At surface of ground.	Below the surface of the ground.				
			0.05 meter.	0.10 meter.	0.25 meter.	0.50 meter.	1 meter.
	Deg. C.	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*
August 4	18.1	26.7	22.5	22.5	22.4	21.0	19.5
5	16.8	25.5	22.5	22.2	23.1	21.0	19.6
6	15.1	20.7	19.7	19.9	21.3	20.7	19.6
7	14.3	19.5	18.1	18 2	19.8	20.4	19.6
8	14.8	18.0	17.8	17.6	18.8	20.0	19.5
9	15.1	18.6	18.1	17.8	19.2	19.5	19.5
10	15.4	19.2	18.1	17.8	18.8	19.1	19.2
11	17.0	22.2	20 0	19.4	19.6	18.7	19.0
12	17.8	22.9	21.0	20.4	20.5	20.3	19.0
13	17.5	22.7	21.3	20.2	20.7	20.6	19.0
14	16.5	23.6	20.7	19.9	20.5	19.6	19.0

On August 4 the temperature of the soil was the same at 0.05, 0.10, and 0.25 meter below the surface, but it was considerably modified the next day. August 8 the temperature at 0.10 meter was lower than at 0.05 and higher at 0.25 than at 0.05. At this time there was a general cooling off, which acted rapidly on the superficial layers as far as 0.10, but it was of little effect at the lower depths. Other modifications followed, and the rise and fall of temperatures at different depths were according to the rapidity and the duration of the atmospheric changes. The temperature of the soil follows that of the air, but it gives better

and more precise indications in regard to the life of the plants. It is considered preferable to take the temperature of the soil, which shows the intensity and the variation of the solar radiation, as well as indicates the quantity of heat received during the day and the amount lost by radiation.

RAINFALL

The monthly rainfall collected by the two pluviometers for 1896 was as follows:

Rainfall during 1896, by months.

Month.	Rainfall.	Month.	Rainfall.
	Mm.		*Mm.*
January	18.0	August	36.8
February	4.9	September	140.6
March	51.9	October	154.0
April	18.2	November	50.1
May	3.2	December	77.7
June	83.1		
July	28.5	Total	667.0

In 1893 the precipitation was 526 mm.; in 1894, 503.4 mm.; in 1895, 493 mm. In 1896 the first part of the year was dry, followed in the summer and autumn by cyclones, storms, and waterspouts, which are

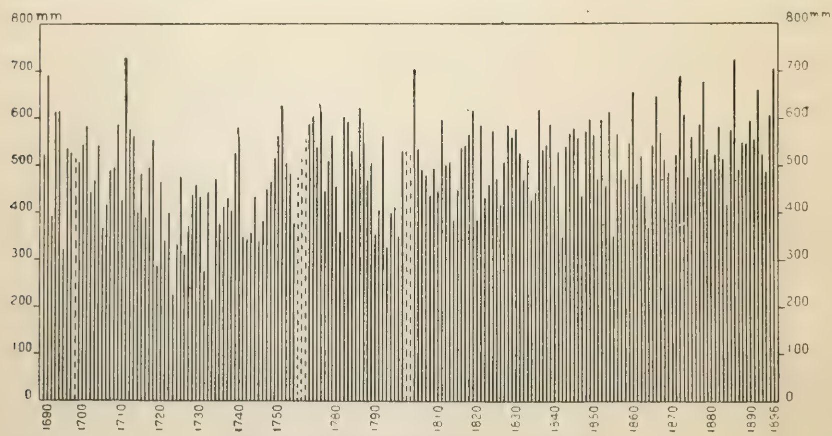

FIG. 8—Annual rainfall at Paris since 1689.

very unusual in France. The rainfall in September was 140.6 mm.; in October, 154.1 mm., an amount not exceeded since 1689, when the first observations were recorded. On account of the continued rains, which were remarkable for the region, the author conceived the idea of comparing the results of all the observations made at Paris since the foundation of the observatory. The first pluviometer was installed on the terrace of the observatory in Paris in 1688, and regular measurements of the rainfall were made from January, 1689, to December 31, 1754,

except during 1698. Other periods of observations extended from 1773 to 1797 and from 1804 to 1872. After January 1, 1873, the observations were made at Montsouris, 3 kilometers south of the observatory of Paris. The conditions at each place are nearly the same. In fig. 8 the rainfall is represented by vertical lines, the height of which corresponds to the quantity of water which fell at Paris from 1689 to 1896, except during the three intervals already mentioned. The diagram is interesting, not only as an exact record, but because it indicates the gradual increase in the rainfall of Paris for the last 200 years. This increase can be seen in the accompanying table, where the averages are given for certain periods:

Annual rainfall at Paris since the year 1689.

Year.	Rainfall.	Year.	Rainfall.
	Mm.		*Mm.*
1689 to 1719	485.7	1825 to 1844	507.5
1720 to 1754	409.4	1845 to 1872	522.4
1773 to 1797	492.5	1873 to 1896	557.4
1804 to 1824	503.7		

It appears that the rainfall in Paris has increased from period to period, or that the older observations were not carefully made at the observatory at Paris.

The condition of the sky during the 24 hours of each day for the year 1896 was noted as follows:

Condition of the sky during the year 1896.

Designation.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Clear	2	3	0	1	6	1	2	0	0	1	2	0
Somewhat cloudy	0	3	4	1	15	8	9	7	5	2	4	0
Cloudy	4	7	6	15	5	9	7	11	5	9	7	3
Very cloudy	7	8	13	10	5	11	12	10	17	13	9	11
Covered	18	8	8	3	0	1	1	3	3	6	8	17
Total	31	29	31	30	31	30	31	31	30	31	30	31
Number of rainy days	3	6	18	9	5	11	9	6	19	20	8	15

It is seen that the cloudiness was very great during the year. The sky was beautiful in May but almost entirely overcast during January and December. There was on an average one rainy day to two days without it, and during 202 days the sky was completely overcast or very cloudy.

SUBTERRANEAN WATERS.

The thickness of the water sheets of wells and the temperature of these waters have important climatological bearing. Observations were continued on two wells, the first 13.56 meters and the second 14.08 meters deep. The temperature of the water in each well was as follows:

Temperature of water in two wells at Juvisy.

Month.	Well A.	Well B.	Average.
	Deg. C.	*Deg. C.*	*Deg. C.*
January	11.3	10.8	11.0
February	11.2	10.7	10.9
March	11.2	10.8	11.0
April	11.4	10.9	11.2
May	11.4	11.3	11.4
June	11.8	11.4	11.6
July	11.9	11.4	11.7
August	11.8	11.6	11.7
September	11.8	11.8	11.8
October	11.5	11.2	11.4
November	11.3	10.8	11.1
December	11.1	10.9	11.0
Annual average	11.47	11.14	11.32

We have here two different sheets of water which, notwithstanding their proximity and almost equal depth, have not exactly the same temperature, it being a little higher in well A (the more shallow one), the difference varying from 0.2 to 0.9°. These sheets differ also chemically. The water in well B is less potable and contains more lime. The annual difference of temperature of the two wells averages 0.33°.

The average temperature of air, soil, and water for 1896 was as follows: Air, 9.80°; at the surface of the soil, 12.78°; the soil at a depth of 0.10 meter, 11.35°; at a depth of 0.50 meter, 11.91°; at a depth of 1 meter, 12.61°; water at a depth of 14 meters, 11.32°. The temperature of the waters of the two different wells varies but little in the course of the year, the cold of winter and the heat of summer being slightly felt.

ACTION OF ELECTRICITY UPON PLANT GROWTH.

The question of the influence of electricity on plants has been the subject of much discussion during the last few years. The results obtained from experience were frequently contradictory. For this reason some experiments were conducted in which copper and zinc plates of 0.70 meter length and 0.45 meter width, bent at right angles, were placed at the extremities of a plate 2 meters wide and 4 meters long and stuck into the ground, the top being a little above the surface. The plates were joined by insulated copper wires. There were thus created zinc-soil-copper piles on which it is supposed that an electric current could be established. The current was rendered more active by adding a Le Clanché pile of three elements and its influence on the germination of seeds tested. August 31, 1894, 56 beans were put in rows on each plate. The current was passed through for ten hours. After this an interrupted current, sometimes during the night and sometimes during the day, was passed through the apparatus. The results are worthy the attention, as the evidence of an electric action is positive.

Effect of electricity on the germination of beans.

Date.	Number of grains germinating.	
	Electric band.	Nonelectrified.
September 4	4	0
5	16	2
10	54	34
11	54	40
13	56	45

This experiment shows that the germination was more rapid in the electrified seed and also that a greater number had germinated. We repeated the experiments in 1895 and 1896 on peas and beans with the following results: May 11, 1895, the same number of seeds were placed in each plate. No difference could be seen during the time of germination. The peas bloomed June 16; the flowers at that time were more numerous and the plants better developed in the electrified plates than in those without. The beans bloomed July 2 over all the plates. The growth of the beans was better in the electrified portion. The peas were gathered twice and gave the following results: Average of electrified portions, 941 gm.; check, 820 gm. Part of the beans were gathered twice and yielded: Electrified, 2,900 gm.; check, 2,250 gm. For the other parts there was but one harvest, which yielded as an average for the electrified portions 1,410 gm., and check, 1,445 gm. One of the electrified portions gave a yield of 375 gm. less than the check. The results of these experiments show that the parts electrified by piles yielded a harvest from 20 to 28 per cent greater than the natural one.

OBSERVATIONS ON TREE TEMPERATURES.

To solve some of the questions relative to tree temperatures, elbow-thermometers were constructed, the bulbs of which were inserted in the heart of the tree. Numerous observations made in 1894, 1895, and 1896 permit the following statements: The internal temperature of trees follows that of the air. The temperature of the air is led into the interior parts, and this transmission is more or less rapid according to the diameter of the tree and the conditions of the tissues. The temperature varies with the diameter of trees of the same species and exposure. In conclusion, conductivity differs according to species. The sudden variations of the temperature in the interior of the trees are avoided by the modification of the sun.

The foregoing are summarized statements of the researches which have been made at the agricultural-climatologic station at the observatory of Juvisy. The author believes that much remains to be discovered in the lines indicated.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Legumin and other proteids of the pea, lentil, horse bean, and vetch, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1897, pp. 321–373*).—The authors give in detail the methods and results of extensive investigations on the proteids of these seeds. They find that they all contain legumin, legumelin, and proteose, and that in addition the seeds of the pea, lentil, and horse bean contain vicilin. No difference was found in the reactions and properties of preparations of each of these proteids from the different seeds.

The results of the investigation are summarized as follows:

"*Legumin.*—Legumin forms the chief proteid constituent obtainable from the vetch, pea, lentil, and horse bean. In the first-named seed about 10 per cent of the meal was found to consist of legumin; in the three other seeds this proteid is associated with vicilin, from which we have no method for its quantitative separation. From the pea about 10 per cent, from the lentil 13 per cent, and from the horse bean about 17 per cent of these mixed proteids were obtained. The lentil contains the least proportion of legumin, which seems to form about two-thirds of the mixed proteids, while the horse bean contains the greatest, as in this seed vicilin is present in relatively small amount.

"Legumin is a globulin, for it dissolves readily in saline solutions and is precipitated therefrom either by dialysis, dilution, or cooling. By dialysis or by cooling it separates in the form of spheroids, which, after settling from the solution, unite to form a plastic mass. By diluting its concentrated solutions the legumin separates as a viscid translucent fluid. This fluid when treated with water becomes opaque and solid, so that the legumin can be converted into a coarse meal by rubbing with a glass rod under water. Conglutin from lupine seeds and amandin from almonds behave similarly, as do gliadin of wheat and rye and hordein of barley when precipitated from alcoholic solutions by dilution with water.

"Solutions containing more than 2 per cent of sodium chlorid dissolve legumin abundantly, those containing less salt have a solvent power rapidly decreasing with the diminishing salt content, so that a 1 per cent salt solution dissolves very little. Saturation with sodium chlorid or magnesium sulphate does not precipitate legumin from its solution in brine, but saturation with sodium sulphate at 34° precipitates it almost completely.

"In pure water legumin is entirely insoluble, but if the solution from which the legumin is precipitated contains acid, this may combine with the legumin and the resulting preparation, like other acid globulins, will then dissolve in pure water.

"If seeds containing legumin are extracted with water, more or less of the legumin is dissolved; from the pea about 4 per cent, from the vetch 2.5 per cent, from the lentil 10 per cent, and from the horse bean 16 per cent. The legumin thus dissolved is largely precipitated by dialysis in water, by the addition of acids and by lime salts, and very slightly by great dilution with water. These aqueous

extracts react strongly acid with litmus, and alkaline with lacmoid, a behavior doubtless due to acid potassium phosphates together with organic acids or acid salts. . . .

"In consequence of the varying proportions of these substances in the different kinds of seeds, different amounts of legumin are thus extracted from them. As the proportion of phosphoric acid to potash in these leguminous seeds is much smaller than in most of the other seeds which we have examined, the character of the salts present may fairly be supposed to differ, and consequently the solubility of the proteids would also differ when the seeds are extracted with water. . . .

"Dissolved in dilute sodium chlorid solution, legumin is precipitated by a little acetic acid, the precipitate being soluble in an excess of sodium chlorid. The solubility of precipitates so produced depends on the relative proportions of salt and acid.

"Legumin extracted without neutralizing the natural acid of the seed and precipitated by dialysis, either directly or after precipitation with ammonium sulphate, is usually converted to a large extent into insoluble 'albuminate.' This 'albuminate' differs from the similar insoluble products obtained from most other globulins, for when treated with salt solution it becomes gelatinous, can not be filtered, and on washing with water shrinks, becomes opaque, and finally granular so that it can be very readily washed on a filter. This substance appears to become hydrated by salt solution and dehydrated by pure water.

"If the acid of the seed is previously neutralized, the globulin extracted by salt solution yields very little if any insoluble 'albuminate,' which indicates that the latter is a product of the action of the acid of the seed. This fact is in harmony with experiments described in a former paper of ours on the action of minute quantities of acid on globulins.[1] In very dilute acids and alkalies in the absence of salts, legumin dissolves readily and abundantly to solutions from which, if at once neutralized, it is precipitated in a form soluble in sodium chlorid solution. By this treatment no evidence of change has been detected. Solutions made with hydrochloric acid are precipitated by a small excess of acid, but those made with acetic acid are not precipitated by any excess of acid.

"Solutions of legumin in 10 per cent sodium chlorid brine are not rendered turbid by long heating in a boiling water bath.

"Dissolved in 10 per cent sodium chlorid brine, legumin is precipitated by a very little hydrochloric acid, but a relatively considerable amount of acetic acid is required to produce a precipitate in such solutions.

"Sodium chlorid solutions of legumin give large precipitates with tannic acid as well as with picric acid, those formed by the latter dissolving in an excess of salt solution if too much picric acid had not been previously added. With mercuric chlorid no precipitate is produced.

"With nitric acid, Millon's and Adamkiewics' tests, proteid reactions are obtained. With the biuret test a violet color is given, which on standing becomes a deep rose red, like that given by peptones.

"Legumin has been supposed by some investigators to contain phosphorus, and therefore to belong with the nucleo-proteids. A careful testing of thoroughly purified samples by fusing with caustic soda and nitrate, and treating the solution of the fusion acidified with nitric acid, with ammonium molybdate, showed that in some of the preparations only just detectable traces of phosphorus were present, while other preparations contained none whatever.

"Although we have examined large numbers of our preparations of the different plant proteids for phosphorus, we have as yet found none which, in carefully purified samples, contained more than a few hundredths of a per cent of phosphorus; a quantity so small that it is reasonable to consider it as a constituent of the ever-present ash.

[1] Connecticut State Sta. Rpt. 1896, p. 369 (E. S. R., 9, p. 515).

"The composition of legumin is shown by the following figures, which, except those for the pea, are averages of a number of preparations from each of the different seeds:

Composition of legumin from different seeds.

	Pea.	Lentil.	Horse bean.	Vetch.	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Carbon	51.74	51.73	51.72	51.69	51.72
Hydrogen	6.90	6.89	7.01	6.99	6.95
Nitrogen	18.04	18.06	18.06	18.02	18.04
Sulphur	.42	.39	.39	.43	.41
Oxygen	22.90	22.92	22.82	22.87	22.88
Total	100.00	100.00	100.00	100.00	100.00

Vicilin.—Vicilin is a globulin associated with legumin in the pea, lentil, and horse bean. But as we have no means of separating vicilin and legumin quantitatively, we can state nothing respecting the amount in which it occurs in these seeds further than that the lentil contains the most and the horse bean the least. In the lentil it probably forms about one-third of the mixed globulins. That vicilin is not a derivative of legumin is almost conclusively proved by the fact that no vicilin can be obtained from the vetch.

"The most remarkable characteristic of vicilin is its content of sulphur, less than that of any other known proteid. This element, it may be noticed, diminishes in quantity with repeated precipitation. . . .

"It would seem possible by sufficiently repeated precipitation to obtain from this proteid preparations free from sulphur.

"In salt solution, vicilin is much more soluble than legumin, so that by repeated precipitation from diluted solutions the two globulins can be separated.

"When solutions of vicilin in 10 per cent brine are heated in a water bath they become turbid at 90° and at 95° flocks separate. When heated for some time at 100° this globulin is almost completely coagulated. In water vicilin is insoluble. In 1 per cent sodium chlorid solution it dissolves considerably, while in slightly stronger solutions it is much more soluble, the solution of the globulin appearing to depend on the presence of enough salt to form a soluble compound.

"In its other reactions it very closely resembles legumin.

"The composition of vicilin we found to be as follows:

Composition of vicilin from different seeds.

	Pea.	Lentil.	Horse bean.	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Carbon	52.36	52.13	52.38	52.29
Hydrogen	7.03	7.02	7.04	7.03
Nitrogen	17.40	17.38	17.52	17.43
Sulphur	.18	.17	.15	.17
Oxygen	23.03	23.30	22.91	23.08
Total	100.00	100.00	100.00	100.00

"*Legumelin.*—We have found legumelin in all the leguminous seeds which we have examined, with the exception of the white bean (*Phaseolus vulgaris*) and the blue and yellow lupines.

"It is difficult to decide whether this proteid should be considered an albumin or a globulin. . . . We now consider legumelin to be more properly classed with the albumins.

"The amount of legumelin which we have found in the seeds discussed in this paper was in the pea 2 per cent, vetch 1.5 per cent, lentil and horse bean 1.25 per cent.

"No definite coagulation point can be stated for legumelin, for the presence of

salts or acids as well as the proportion of dissolved legumelin have a great effect on the temperature at which coagulation takes place. Coagulated legumelin is soluble in very dilute alkalies. . . .

"In dilute hydrochloric or acetic acid the coagulum is not soluble. By adding 10 per cent of sodium chlorid to solutions containing legumelin, and then acetic acid, the acid compound of this proteid is precipitated, which dissolves in water to a solution that on neutralization gives a precipitate insoluble in water. . . .

"Owing to the impossibility of separating legumelin from associated proteose, except in a coagulated state, we have learned but little respecting its reactions.

"In the following table we give the average of analyses which we have made of coagulated legumelin from different seeds:

Composition of coagulated legumin from different seeds.

	Pea.	Lentil.	Horse bean.	Vetch.	Adzuki bean.	Cowpea.	Soy bean.	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Carbon	53.31	53.22	53.03	53.31	53.97	53.25	53.06	53.31
Hydrogen	6.99	6.82	6.97	6.97	7.01	7.07	6.94	6.97
Nitrogen	16.30	16.27	16.22	16.24	16.31	16.36	16.14	16.26
Sulphur	1.06	.94	1.30	1.11	.88	1.11	1.17	1.08
Oxygen	22.34	22.75	22.48	22.37	21.83	22.21	22.69	22.38
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

"Ritthausen recognized the presence of this proteid in the horse bean and pea, and gave analyses of coagula obtained by boiling extracts of these seeds. These analyses, however, do not agree well with each other and only in a general way with ours. On account of the solubility in alkali of the heat coagulum of this proteid, he did not consider it to be albumin.

"*Proteose.*—As the proteose of these seeds is present in small amount and is difficult to obtain pure, we have not as much information respecting it as is desirable. The pea appears to contain about 1 per cent, the horse bean about 0.5 per cent, and the lentil and vetch evidently less. It is probable that more or less of this proteose may be lost by diffusion, for 10.5 gm. of what was doubtless nearly pure proteose from the pea, after solution and dialysis yielded only about 6 gm. when reprecipitated. We have obtained a few of the reactions of proteose from the pea and horse bean, but no reactions of this proteid from the lentil and vetch.

"By saturation with salt, solutions of the proteose of the pea and horse bean are not precipitated, but by subsequently adding salt saturated acetic acid, a large part of the pea proteose separates, while all but a trace of that from the horse bean is thrown down. Nitric acid in the aqueous solutions of the pea proteose gives no precipitate unless the solution is previously saturated with salt, when a precipitate, soluble on warming and reappearing on cooling, is given by that part of the proteose precipitable by acetic acid from a salt saturated solution, while the part not thus precipitable gives only a turbidity. Both these parts of the pea proteose are precipitated by copper sulphate, and give a rose-red biuret reaction.

"The composition of the preparations from these seeds was found as follows:

Proteose.

	Pea.		Lentil.	Horse bean.		Vetch.
	46.	47.	68.	89.	98.	22.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Carbon	50.24	49.66	50.17	50.24	49.96	50.85
Hydrogen	6.76	6.78	6.77	6.66	6.76	6.75
Nitrogen	17.35	16.57	16.81	17.11	16.95	16.65
Sulphur	1.25	1.40	1.27	1.87	2.75	25.75
Oxygen	24.40	25.59	23.98	24.12	23.58	
Total	100.00	100.00	100.00	100.00	100.00	100.00

"46. Precipitated by saturating with salt and adding acetic acid.

"47. From the filtrate from 46.

"68. Total proteose precipitated by alcohol.

"89. Ditto.

"98. Precipitated from salt saturated solution by acetic acid.

"22. Total proteose precipitated by alcohol.

"If the difficulty encountered in purifying these preparations of proteose and the different methods by which they have been obtained are considered, the agreement between them, except for the sulphur in those from the horse bean, makes it probable that these figures quite nearly represent the composition of this substance."

Proteids of the soy bean, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1897, pp. 374–382*).—The seeds of 2 varieties were studied, the yellow soy bean and the variety known in Japan as kiyusuki diadzu. From the results of the investigations, which are given in detail, the author deduces the following conclusions:

"The soy bean contains as its chief proteid constituent glycinin, a globulin similar in properties to legumin, but of somewhat different composition, containing nearly twice as much sulphur, 0.4 per cent more carbon, and 0.5 per cent less nitrogen.

"We give as the composition of this proteid the results of our analysis of preparation 9, which was obtained from a neutral and perfectly clear extract, for we believe that this represents more accurately the true composition of glycinin than the average of all the preparations: Carbon, 52.12; hydrogen, 6.93; nitrogen, 17.53; sulphur, 0.79; oxygen, 22.63 per cent.

"The soy bean contains a more soluble globulin which resembles phaseolin in composition, and, so far as we could ascertain, also in its reactions. The amount of this proteid is small and the evidence that it is in reality phaseolin was not wholly satisfactory.

"Besides these globulins about 1.5 per cent of the albumin-like proteid legumelin was obtained. We have found legumelin in a number of other leguminous seeds, the pea, vetch, horse bean, lentil, adzuki bean and cowpea. The properties of legumelin are given in our paper [noted above]. The composition of legumelin as found in the soy bean is as follows: Carbon, 53.06; hydrogen, 6.94; nitrogen, 16.14; sulphur, 1.17; oxygen, 22.69 per cent.

"A small quantity of proteose was also obtained from the soy bean, having the following composition: Carbon, 48.76; hydrogen, 6.28; nitrogen, 16.14; sulphur and oxygen, 28.82 per cent.

"Owing to the small amount of proteose no evidence was obtained as to the purity or individuality of this preparation."

On the solubility of tricalcium phosphate and apatite in water, J. JOFFRE (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 9, pp. 372–375*).—Tricalcium phosphate was subjected to the action of water for two months. The solution obtained was filtered, evaporated to dryness, and phosphoric acid determined in the residue. The solubility of the phosphate was found to be 0.009 gm. per liter of water. When the phosphate was subjected to the action of water charged with carbon dioxid for the same length of time the solubility was found to be 0.153 gm. per liter. Apatite treated in the same way showed a solubility in pure water of 0.002 gm. per liter; in water saturated with carbon dioxid 0.014 gm. per liter. It is thus seen that the apatite is much less soluble than tricalcium phosphate. Monocalcium phosphate was mixed with carbonate of lime. After three or four days the phosphoric acid

soluble in water was extracted and the residue treated with a large quantity of water charged with carbon dioxid. By this means 0.161 gm. of tricalcium phosphate per liter was dissolved from the residue insoluble in water, an amount very nearly identical with that dissolved by treating tricalcium phosphate in the same way.

These results indicate that when superphosphates are applied to the soil, although a large part of the soluble phosphoric acid is converted into the tricalcium form, it is so uniformly distributed throughout the soil that it is readily dissolved by the carbon dioxid present in the soil or by the acids secreted by the roots of plants.

A method for distinguishing bone phosphate from mineral phosphate, F. MARTINOTTI (*Staz. Sper. Agr. Ital., 30 (1897), No. 8, pp. 663–668*).—The method is based upon the difference in silica content of the different kinds of phosphates. The silica is removed before the determination of phosphoric acid by evaporating the acid solutions to dryness. In the large series of analyses reported the smallest amount of silica found in mineral phosphates was 5.25 per cent, while the greatest amount found in bone phosphates was 0.9 per cent. In bone ash as high as 3 per cent of silica was found. In superphosphates prepared from mineral phosphates the minimum amount of silica was 1.2 per cent. In case of bone ash superphosphates the maximum silica content was 0.8 per cent. Double superphosphates were found to contain about 3 per cent of silica. In a mixture of bone superphosphate and mineral superphosphate the smallest amount of silica found was 2.26 per cent.

From his investigations the author draws the conclusions that (1) mineral phosphates can be distinguished from bone phosphates by the relative quantities of silica which they contain; and (2) bone phosphates and bone superphosphates that contain more than from 0.8 to 1 per cent of silica are adulterated with mineral phosphates and mineral superphosphates.

Proteids of the soy bean, T. B. OSBORNE and G. F. CAMPBELL (*Jour. Amer. Chem. Soc., 20 (1898), No. 6, pp. 419–428*).—Reprinted from Connecticut State Station Report for 1897 (see p. 218).

Proteids of the pea, lentil, horse bean, and vetch, T. B. OSBORNE and G. F. CAMPBELL (*Jour. Amer. Chem. Soc., 20 (1898), Nos. 5, pp. 348–375; 6, pp. 393–419*).—A series of papers reprinted from Connecticut State Station Report for 1897 (see p. 214).

On the chemistry of chlorophyll, L. MARCHLEWSKI (*Jour. Prakt. Chem., 1898, Nos. 5–7, pp. 330–334*).

On the sugar in orange peel, J. FLATAU and H. TABBÉ (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 9, p. 408*).

The formation of cane sugar from dextrose in the cell, J. GRÜSS (*Ztschr. Ver. Rübenz. Ind., 1898, No. 507, pp. 333–343*).

Composition of the ashes of some raw tanning materials, W. K. ALSOP and J. H. YOCUM (*Jour. Amer. Chem. Soc., 20 (1898), No. 5, pp. 338–340*).—Analyses of chestnut-oak bark, hemlock bark, quebracho wood, and oak-bark extract.

BOTANY.

Investigations on the native vegetation of alkali lands, J. B. DAVY (*California Sta. Rpt. 1895-1897, pp. 53-75, pls. 8, fig. 1*).—The object of this investigation was to ascertain if possible whether the characteristic plants of alkali plats would indicate the kind of alkali present and the degree of its impregnation, so as to enable any one to determine the possibility of reclamation without reference to the station.

An introductory note by E. W. Hilgard reviews the previous investigations of the station regarding alkali lands which, summed up, shows that the salts found impregnating alkali lands consist in the main of varying proportions of sodium sulphate, sodium carbonate, and common salt. The total content of this mixture varies from a small fraction of 1 per cent to more than 12 per cent of the total weight of the soil taken to a depth of 4 ft. Of the three compounds named, sodium carbonate, or black alkali, is the most injurious to vegetable growth and to the tilling qualities of the soil. In reclaiming alkali lands for cultural purposes the first thing necessary is a transformation of the carbonate into sulphate of soda by the addition of gypsum. In addition to the salts already mentioned other alkalies are found in varying proportions, but as most of these are in the form of soluble plant food they are available for plant growth as soon as the injurious effects of the surplus of other constituents is removed.

The resistance or tolerance of the several salts by plants varies greatly for the different plants and for the different salts. Thus chenopodiaceous plants are in general very resistant, while, on the other hand, leguminous plants resent even small quantities of any of the injurious alkalies. The Compositæ are rather tolerant of alkali, while most cultivated grasses are sensitive to it.

With a few exceptional cases, the investigations of the station have shown that the bulk of the salts in alkali lands may at all times be found within about 4 ft. of the surface, and sometimes, as during a very dry season, they may accumulate almost wholly within 6 in. of the surface. Upon the basis of these facts it is thought an estimate of the aggregate amount of alkali liable to influence vegetable growth on any land can be made and the methods of reclamation determined. This might be determined by chemical analysis of the soil, but to avoid this expense to the landowners a simpler method was sought, a preliminary summary of which is given in the report. The author collected samples of alkali soils upon which various plants grew at a number of places, and these samples, 58 in number, were analyzed and are reported upon by the agricultural chemist, R. H. Loughridge.

In studying the natural vegetation of alkali lands the author made several visits to parts of California that are noted for their alkali soils, and in addition to the soil samples taken collected over 1,500 sheets of

botanical specimens, a number of samples of water, and native seeds, roots, etc.

From a careful study of the plants collected it was found that most of them were confined to particular soils, at least when in the wild state. These plants are therefore designated as characteristic alkali plants, the most conspicuous of which are Sesuvium, samphire, saltwort, *Kochia californica*, yerba mansa (*Anemopis californica*), *Nitropila occidentalis*, tall tar weed (*Centromadia pungens*), several species of Atriplex, alkali heath (*Frankenia grandifolia campestris*), tussock grass, salt grass, fine top salt grass (*Sporobolus asperifolius*), bushy goldenrod, grease wood (*Allenrolfea occidentalis*), and several species of Tissa. In addition to these were found a number of introduced plants which occur as weeds and which tolerate the abnormal conditions of soil and climate. Among these are the common sunflower, sow thistle, mallow, bitter melilot, plantain, Bermuda grass, and *Erigeron canadensis*. In all there are known to be at least 197 species of plants natives of California which are restricted to alkali soils.

One of the striking features of the alkali plats is said to be the gregarious nature of the plants found upon them. Some species are rare and may be described as local, while others occur in distinct belts or zones of vegetation forming the principal and often exclusive vegetation over large areas, while at least two species, salt grass and alkali heath, may be called cosmopolitan.

Particular studies were made of the different belts or zones as indicated by the plant growth, and samples of soil in these characteristic belts were collected and analyzed. The minimum and maximum of alkali salts tolerated by each plant are given, although the figures are not necessarily from one and the same soil. The observations and analyses when summarized show among other results the following:

Pounds of alkali per acre in one foot of soil from the different belts.

Belts.	Sulphates.		Carbonates.		Chlorids.		Total salts.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Scrub saltbush (*Atriplex polycarpa*)	Trace.	37,880	240	19,000	None.	21,360	840	78,240
Bushy Golden-rod (*Bigelovia veneta*)	680	15,360	None.	7,480	None.	3,720	1,800	24,320
Saltwort (*Sueda* sp.)	36,000	176,000	360	24,240	26,000	105,800	74,480	306,040
Tussock grass (*Sporobolus airoides*)	3,440	98,920	680	13,480	360	55,680	6,600	155,280
Grease wood (*Allenrolfea occidentalis*)	7,440	146,000	160	3,400	10,400	85,880	27,320	194,760
Samphire (*Salicornia* sp.)	55,320	176,000	320	24,240	5,560	105,800	61,240	306,040

The last two belts indicated in the table contain such a large amount of injurious salts as to seem incapable of profitable reclamation. Of the belt characterized as the tussock-grass belt, while the total content of alkali in the soil is high, the grass, which grows abundantly, is said

to be readily eaten by stock, and further investigations are desired relative to its adaptation and possible use.

Summing up the results as far as possible, the distribution of plants in belts or zones is believed to be due to physical and chemical conditions of the soil, and these plants may be used as indicators of soil conditions. The Biglovia and scrub saltbush indicate, from the data at hand, a light gravelly soil with apparently a low alkali content chiefly composed of sulphates. The minimum of sulphates is least and the maximum highest in the scrub saltbush belt, but black alkali and chlorids are least in the Biglovia belt. Samphire indicates a moist soil with excessive chlorids and sulphates. Grease wood, so far as determined, occurs only in a moist soil where sulphates and common salt are heavy and carbonates light. Saltwort depends on heavy chlorids and heavier chlorates with carbonates varying between 360 and 24,000 lbs. per acre. The full extent of the value of these and other plants as alkali indicators can not yet be determined.

The author suggests quite a number of plants that may be cultivated on alkali soils. Among these are the saltbushes, samphire, sugar beet, spinach, mangel-wurzel, *Chenopodia quinoa*, Australian saltbushes, etc. Sunflowers are reported growing wild on a soil which contains 9,820 lbs. sulphates, 1,400 lbs. carbonates, 920 lbs. chlorids, and 1,440 lbs. nitrates in the first foot of soil. Other plants belonging to this same family which grow wild on moderately alkali lands are the Jerusalem artichoke, oyster plant, chicory, true artichoke (*Cynara scolymus*). Valuable fodder plants which are known to grow on decidedly alkaline soils are mentioned, among the more promising of which are *Modiola decumbens*, quack grass, tussock grass (*Sporobolus airoides*), and water grass (*Beckmania erucæformis*). In conclusion the author gives a preliminary list of plants suitable for cultivation on alkali soils, dividing them into those which are adapted to strong alkali and those which are not tolerant of the strongest alkali. The list is as follows:

On strong alkali.—Saltbushes, modiola, wild millet or water grass, *Kolreuteria paniculata*, sac-saoul (*Haloxylon ammodendron*), *Salsola soda*, and *S. indica*, and kochia (*Kochia* spp.).

Apparently not tolerant of the strongest alkali.—Sunflower, Jerusalem artichoke, beets, spinach, onion, celery, asparagus, *Elæagnus angustifolius*, and the Peruvian ground cherry (*Physalis peruviana*).

Fodder plants.—Slender grass (*Leptochloa imbricata*), Johnson grass, quack grass, tall smooth panic grass (*Panicum virgatum*), smooth bunch grass (*Atropis lævis* and *A. californica*), obtuse meadow grass (*Eragrostis obtusiflora*), wild rye (*Elymus condensatus*), alkali saccatone (*Panicum bulbosum*), fiorin, Bermuda grass, jointed barley grass, tea tree, and myall (*Acacia* spp.).

Investigations on various economic plants, J. B. DAVY (*California Sta. Rpt. 1895–1897, pp. 265–270*).—This is the report of the assistant botanist. Among other economic notes the author suggests as bee plants for late winter and early spring in California the follow-

ing: Tagasaste (*Cytisus proliferus albus*), *C. canariensis*, borage (*Borago officinalis*), honey flower (*Melianthus major*), and *Colletia ephedra*.

Brief notes are given on several forage plants which seem promising for different parts of the State. *Aristida oligantha* is considered an excellent grass, and what, from an incomplete specimen, appears to be *Bromus sterilis* is also considered promising for the sage-brush lands in certain parts of the State.

Notes are given on several weeds and on an unidentified fiber plant said to occur very abundantly in Monterey County. The latter will be further investigated.

Suggestions are made for tree planting in the streets around San Francisco Bay. Numerous trees are suggested and described.

Biological studies of Alinit, J. STOCKLASA (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), Nos. 1, pp. 39–41; 2, pp. 78–86; 3–4, pp. 119–130; 7, pp. 284–295*).—Extensive studies of *Bacillus ellenbachensis alpha* are reported. The author considers it as probably identical with *B. megatherium*.

Concerning Watson's climatic zones, S. M. MACVICAR (*Jour. Bot. [London], 36 (1898), No. 423, pp. 82–85*).

Abnormal cell division in the root tip of Allium cepa, B. NĚMEC (*Sep. Akdr. Sitzber. K. Böhm. Gesell. Wiss. Math-naturw. Cl., 1898, pp. 10, pl. 1*).

The origin of the vascular tissues in the root tip of monocotyledons, L. BUSCALIONI (*Atti R. Acad. Lincei, 5. ser., 7 (1898), No. 3, pp. 60–62*).

Concerning the equilibrium between top and root of trees, P. FOSSIER (*Rev. Eaux et Forêts, 3. ser., 2 (1898), No. 9, pp. 288–291*).

The replacement of main stems by branches, A. BOIRIVANT (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 13, pp. 981–984*).

Concerning the pulvini of Oxalis and Phaseolus, S. SCHWENDENER (*Sitzber. Kgl. Preuss. Akad. Wiss. Berlin, Phys.-Math. Cl., 12 (1898), pp. 176–181, pl. 1*).

On apogamy and the development of sporangia upon fern prothallia, W. H. LANG and G. A. CLARK (*Bot. Centbl., 74 (1898), No. 3, pp. 72–77*).

Comparative anatomy of floating and submerged leaves, E. WOLLENWEBER (*Inaug. Diss., Freiburg, 1897, p. 349; abs. in Bot. Centbl., 74 (1898), No. 6, pp. 184–186*).

Influence of low temperatures on the direction of sprouts, H. VÖCHTING (*Ber. Deut. Bot. Gesell., 16 (1898), No. 3, pp. 37–53, fig. 1*).

The importance of phosphoric acid in the physiology of plants, MEYER (*Fühling's Landw. Ztg., 47 (1898), No. 9, pp. 341–350*).—A general discussion of the subject.

Concerning starch and sugar formation in barley and malt, J. GRÜSS (*Wchnschr. Brau., 15 (1898), No. 7, pp. 81–84, pl. 1*).

Acidity of the root sap of citrus trees, E. W. HILGARD (*California Sta. Rpt., 1895–1897, pp. 181–183*).—Determinations of the acidity of dry and fresh roots of various citrus trees are reported, with a note on the object of the determinations.

Investigations concerning chlorophyll, G. BODE (*Inaug. Diss., Jena, 1898*).

Concerning protoplasm and active albumen, O. LOEW (*Bot. Centbl., 74 (1898), No. 1, pp. 5–13*).

On the reaction of protoplasm to thermal stimuli, K. L. SCHAEFER (*Flora, 85 (1898), No. 2, pp. 135–140*).

Researches on the presence of hydrocyanic acid in different plants, A. HÉBERT (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 7, pp. 310–313*).

Concerning proteid formation in plants, W. ZALESKI (*Ber. Deut. Bot. Gesell., 15 (1897), No. 10, pp. 536–542*).

A compendium of botany, T. BOKORNY (*Lehrbuch der Botanik. Leipsic, 1898, pp. VI + 226, figs. 170*).

FERMENTATION—BACTERIOLOGY.

Spore formation among Russian wine yeasts, A. NASTUKOFF (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 10, pp. 420, 421*).—Out of 35 specimens of yeasts studied 15 formed spores at 25° C. in 48 hours and 13 at 15° C. in 72 hours.

On the question of alcoholic fermentation without living yeast cells, M. VON MANASSEÏN (*Ber. Deut. Chem. Gesell., 30 (1898), No. 19, pp. 3061, 3062*).

On some micro-organisms of wine, F. BORDAS, JOULIN, and DE RACZKOWSKI (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 14, pp. 1050–1053*).

Introduction to the study of bacteriology with special reference to microscopical technique (*Einführung in das studium der Bakteriologie mit besonderer Berücksichtigung der Mikroskopischen Technik. Leipsic: Geo. Thieme, 1898, 5. ed., pp. VIII + 631, pls. 90*).

On the biology of bacteria, G. SCHLATER (*Biol. Centbl., 17 (1897), No. 2, pp. 833–846; abs. in Bot. Centbl., 74 (1898), No. 1, pp. 17, 18*).

Concerning the biology of Bacillus baccarinii, L. MACCHIATI (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898). No. 8, pp. 332–340*).—The author gives a sketch of the biology of the organism which is said to be the cause of "mal nero" or the bacterial gummosis of grapes.

Concerning the species of acetic bacteria, M. W. BEIJERINCK (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 6, pp. 209–216*).

Concerning the occurrence of bacteria, especially of the tubercle bacteria in living plant tissues, O. ZINSSER (*Inaug. Diss., Leipsic, 1897, pp. 30; Bot. Centbl., Beihefte, 7 (1898), No. 5, pp. 337–339*).

New methods of bacterial investigation, N. J. C. MÜLLER (*Neue Methoden der Bakterien forschung. Sep. Abdr. Beitrag. Wiss. Bot., pt. 2, pp. 97–176, pls. 20. Stuttgart: E. Nägele, 1898*).

METEOROLOGY.

Meteorological observations, A. O. LEUSCHNER and C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 304–306, 326–328, 330–332, 352, 353, 365–367, 414, 415*).—The data reported include a synopsis of observations at Berkeley during 10 years (June 30, 1887, to June 30, 1897) on temperature, pressure, humidity, precipitation, and direction of the wind; at the Foothill Substation on seasonal rainfall (1889–1896), mean monthly rainfall (1893–1896), dates of killing frosts (1893–1896), sunshine and cloudiness (October, 1894, to June, 1896), and temperature (October, 1894, to June, 1896) at two points having a difference of 180 ft. in elevation; at the Southern Coast Range Substation on the character of the seasons of 1886–1896, rainfall (October, 1895, to May, 1896), and temperature (July 1, 1895, to June 30, 1896); at the San Joaquin Valley Substation on seasonal (October to May) rainfall at Tulare (1892–1897), the average and extreme temperatures at Tulare for 20 years, and dates of frosts (1892–1896); at the Southern California Substation on temperature, precipitation, and cloudiness (July 1, 1894, to June 30, 1896); and at the Santa Monica Forestry Substation on maximum, minimum, and average temperature (July, 1893, to April, 1897), and rainfall (1893–1897).

The summaries of observations at Berkeley for the years ending June 30, 1896, and June 30, 1897, are as follows:

Meteorological summaries for 1896 and 1897.

	1896.	1897.
Pressure (inches):		
Mean	30.048	30.034
Highest	30.533 (Dec. 30)	30.399 (Jan. 2, Feb. 23)
Lowest	29.701 (Apr. 23)	29.466 (Feb. 18)
Temperature (degrees F.):		
Mean of the year	53.6	53.9
Maximum	92.5 (May 26)	91 (May 19)
Minimum	34 (Dec. 22, Mar. 3, 4)	33.7 (Nov. 27)
Precipitation (inches):		
Total rainfall	28.713	28.944
Dew and fog	0.035	0.080
Humidity (per cent):		
Mean	83.2	86.1
Maximum	98 (May 11)	99 (Oct. 5, Apr. 7, May 7)
Minimum	32 (Nov. 16)	51 (Oct. 18, 22)
Number of clear days	202	145
Number of fair days	70	106
Number of cloudy days	94	114
Number of foggy days	108	67
Number of days on which rain fell	63	71

Meteorological record for 1896 (*New York State Sta. Rpt. 1896, pp. 695–711*).—Tabulated daily and monthly summaries of observations on sunshine and temperature and a monthly summary of observations on precipitation for the period from 1882 to 1896.

The practical importance of agricultural-meteorological observations and brief instructions for carrying them out, P. I. Brounov (*Rpt. Met. Bureau Sci. Committee Min. Agr. and Gov. Estates. St. Petersburg, 1897, pp. 157, figs. 25; abs. in Selsk. Khoz. i Lyesov., 186 (1897), July, pp. 239, 240*).

WATER—SOILS.

Alkali and alkali soils, R. H. Loughridge (*California Sta. Rpt. 1895–1897, pp. 38–53*).—The causes of failure of gypsum to correct alkali in certain cases are discussed. Three of the principal causes are noted: (1) Ignorance of the character of the alkali, gypsum being ineffective on white alkali; (2) the impurity of the gypsum used; (3) insufficient applications of gypsum. Theoretically the amount of gypsum applied should be about one-third more in weight than the amount of carbonate of soda present in the alkali. In experiments it was found "(1) that the amount of gypsum to be applied to alkali soils must be about double that of the carbonate of soda present; (2) that the effect is then apparent within 2 or 3 days; and (3) that the effect is probably permanent in the conversion of the carbonate of soda into the sulphate."

The results of examinations of alkali soils used for experiments with various plants at Tulare and Southern California substations are reported in detail. From the data thus secured the following preliminary statement as to the ability of different crops to withstand the various salts contained in alkali has been prepared.

Tolerance of plants for the several salts of alkali.

	Maximum of each in pounds per acre, one foot in depth.				
	Sodium sulphate.	Sodium carbonate.	Sodium chlorid.	Sodium nitrate.	Total alkali.
GRASSES.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Japanese wheat grass (*Agropyron japonicum*)	3, 280	3, 360	3, 280	1, 160	9, 320
Fioren grass (*Agrostis stolonifera*)	2, 560	....	....	3, 080	5, 640
Awnless brome grass (*Bromus inermis*)	8, 920	2, 520	920	3, 080	12, 680
Schrader's brome grass (*B. schraderi*)	7, 560	2, 520	1, 520	1, 680	12, 880
Egyptian millet (*Eleusine coracana*)	1, 920	2, 320	200	120	4, 560
Sheep fescue (*Festuca ovina*)	3, 280	2, 520	920	1, 160	6, 000
Meadow fescue (*F. pratensis*)	4, 400	640	1, 040	2, 640	8, 720
Hard fescue (*F. duriuscula*)	880	2, 120	....	2, 640	6, 120
Tall fescue (*F. elatior*)	1, 320	2, 520	920	....	4, 760
Many-flowered millet (*Milium multiflorum*)	1, 760	840	480	1, 280	4, 360
Many-flowered paspalum (*Paspalum dilatatum*)	1, 760	2, 120	....	2, 240	6, 120
Meadow soft grass (*Holcus lanatus*)	960	920	200	....	2, 080
Italian rye grass (*Lolium italicum*)	1, 760	920	480	1, 280	4, 360
English rye grass (*L. perenne*)	2, 560	2, 320	480	3, 080	5, 640
Bearded darnel (*L. temulentum*)	3, 280	1, 080	480	1, 160	6, 000
Blue grass (*Poa pratensis*)	880	1, 520	....	280	2, 680
Rough-stalked meadow grass (*P. trivialis*)	1, 920	2, 320	200	280	4, 560
Orchard grass (*Dactylis glomerata*)	2, 200	2, 320	360	1, 640	5, 040
LEGUMES.					
Anthyllis vulneraria	2, 200	840	360	1, 640	5, 040
Cowpeas	1, 920	2, 320	200	120	4, 560
Lentil, large blonde	1, 760	2, 520	920	1, 280	4, 760
Lentil, petite rouge	4, 400	2, 520	1, 040	2, 640	8, 720
Lentil, petite	3, 280	2, 520	920	1, 280	720
European blue lupine (*Lupinus angustifolius*)	3, 280	2, 120	480	3, 080	6, 120
European blue lupine (*L. angustifolius*, var?)	960	920	200	....	2, 080
White lupine (*L. albus*)	8, 920	2, 120	920	2, 240	12, 680
Yellow lupine (*L. luteus*)	2, 200	2, 120	360	2, 240	6, 120
Californian lupine (*L. carnosulus*)	2, 360	3, 360	3, 280	320	9, 320
Snail clover (*Medicago turbinata*)	960	920	200	....	2, 080
Crimson clover (*Trifolium incarnatum*)	1, 760	2, 120	....	2, 240	6, 120
Red clover (*T. pratense*)	880	1, 520	....	280	2, 680
White clover (*T. repens*)	1, 320	2, 520	920	....	4, 760
Hairy vetch (*Vicia villosa*)	2, 560	920	1, 040	3, 080	8, 720
Common vetch (*V. sativa*)	2, 560	....	....	3, 080	5, 640
Bokhara clover (*Melilotus alba*)	1, 680	....	....	....	1, 680
Birdsfoot clover (*Lotus villosus*)	1, 760	2, 120	....	2, 240	6, 120
Tall esparcet (*Hedysarum coronarium*)	2, 560	....	....	3, 080	5, 640
MISCELLANEOUS.					
Barley	11, 120	7, 040	4, 520	4, 320	20 520
Wheat	11, 120	7, 040	4, 520	4, 320	20, 520
Popcorn	2, 360	3, 360	3, 280	5, 040	9, 320
Russian sunflower	9, 820	1, 400	920	1, 440	12, 680
Modiola	6, 800	4, 760	40, 840	....	52, 400
Sugar beets	8, 920	3, 360	3, 280	1, 440	12, 680
Sugar beets	7, 160	3, 040	1, 520	560	10, 840
Sugar beets	2, 360	3, 360	3, 280	320	9, 320
Australian saltbush (young seedlings)	10, 360	9, 320	11, 200	....	30. 920
Cotton	1, 680	....	....	....	1, 680
Japanese hemp	1, 680	....	....	....	1, 680
Grapevines	13, 570	1, 610	7, 980	670	23, 830

"Continued observation and experiments will without doubt enlarge the limits of tolerance as given in the tables. . . . The results represent the maximum amount per acre of each salt found in any soil where that particular plant was found growing, and without reference to the other salts in the same soil. Thus for the cowpea the maximum of carbonate of soda was found in one soil, that of the sulphate in another, and the chlorid in still some other soil."

Analyses are given of a number of samples of alkali soils sent to the station for examination from different parts of the State.

A chemical study of some typical soils of the Florida peninsula, A. A. PERSONS (*Florida Sta. Bul. 43, pp. 601–714*).—The first part of the bulletin is devoted to a popular discussion of the following

topics: The development of scientific agriculture, the value of a chemical analysis, the origin of soils, the composition of soils, the inorganic soil constituents, description of the organic soil elements, distinction between nitrogen and ammonia, seaweed as a source of nitrogen, the inorganic soil elements, the effect of lime on soils, explanation of the different forms of phosphoric acid, the home manufacture of acid phosphate, the classification of soils, influence of mechanical condition on soil fertility, average weight of different types of soil, humus and its influence on soil fertility, peninsular soils deficient in humus, leguminous crops—beggar weed and velvet bean, nitrification and rotation of crops, irrigation and drainage, and effects of subsoiling.

The second part is devoted to analyses by the author and his assistant, J. P. Davies, of pine, hammock, and sand soils and subsoils, showing coarse earth, fine earth, humus, nitrogen, and moisture at 100° C., and water and organic matter and the mineral constituents in the fine earth. The principal results are given in the following table:

Important soil ingredients in the soils of the central and southern portions of the Florida peninsula.

County.	Insoluble residue.	Humus.	Nitrogen.	Potassium oxid.	Phosphoric acid	Calcium oxid.
	Per cent.	*Per ct.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Brevard	97.5085	0.24	0.0378	0.0086	0.0336	0.2100
	98.2100	.21	.0252	.0111	.0192	.1075
	87.5915	.39	.0434	.0588	.0608	4.8787
	97.5710	.10	.0091	.0038	.0527	.0200
	99.0485	.08	.0021	.0041	.0080	.0000
	98.1951	....	.0261	.0198	.0333	.1150
Dade	93.8197	2.51	.0364	.0574	.0280	.0200
	93.4032	1.48	.0833	.0033	.0232	.0850
	98.4256	.26	.0084	.0027	.0288	.3025
	97.2740	.22	.0112	.0089	.0262	.0362
De Soto	97.4975	.40	.0497	.0106	.0080	.0537
Hillsboro	91.4202	1.36	.0672	.0014	.3224	.1375
	96.4472	.30	.0518	.0011	.1008	.1450
Lee	82.4682	1.73	.2464	.0125	1.2815	3.3025
	96.4305	1.37	.1162	.0058	.0208	.0000
	96.2090	.80	.0714	.0000	.0496	.0725
	97.3085	.93	.0630	.0125	.0112	.0000
	97.4155	.63	.0350	.0055	.0064	.0350
Marion	94.6090	.88	.0074	.0086	.2168	.0962
Orange	96.4818	.45	.0294	.0000	.1027	.0137
	98.2060	.25	.0028	.0034	.0792	.0000
	98.8857	.14	.0014	.0106	.0224	.0000
	96.4261	....	.1100	.0160	.1175	.0624
Osceola	97.4670	.67	.0266	.0038	.0056	.0112
	97.7362	.70	.0252	.0037	.0088	.0075
	96.6082	.87	.0434	.0060	.0384	.0300
Pasco	94.9472	.97	.0406	.0024	.1360	.0850
Polk	99.4830	.02	.0042	.0038	.0064	.0000
	95.2190	.50	.0126	.0000	.2768	.0125
	89.3950	1.15	.0294	.0000	2.4000	.1125
	96.3590	.47	.0084	.0014	.2176	.0212
	97.9165	.35	.0098	.0000	.0224	.0062
	98.5205	.29	.0084	.0038	.0136	.0000
Volusia	98.3022	.15	.0266	.0043	.0136	.0437
	96.6618	.25	.0280	.0157	.0592	.0222
	96.0852	....	.0890	.0208	.1660	.0526
Average	95.9876	.64	.0413	.0091	.1635	.2805

Similar analyses are given of 11 samples of muck soils taken at depths of from 6 in. to 4 ft.

The analyses show that the pine, hammock, and sand soils are essen-

tially of a sandy character, and are most deficient in potash and least in phosphoric acid. Frequently they are deficient in humus.

"The muck soils of the peninsula are uniformly of a fertile character. The purest muck beds, occupying vast areas in the central and southern peninsula, extending from Osceola County southward into the Everglades, are unusually rich in nitrogen, but, in most cases, are deficient in potash, phosphoric acid, and lime. Vast tracts of this land in Osceola and Dade counties have already been drained by cutting canals through the muck beds, and are now in a high state of productiveness. Other rich muck areas lie along either bank of the Kissimmee River, which connects Lake Okeechobee with Lake Kissimmee. Still other vast muck deposits occur south of Lake Okeechobee and extend into the Everglades. In addition to the above, muck deposits of varying areas occur all over Florida.

"As a rule, the purest muck deposits contain the smallest stores of mineral plant food, but are richest in nitrogen. Many samples are reported in this bulletin, however, which are very pure mucks and which, in addition to nitrogen, contain noticeably large supplies of both phosphoric acid and lime. Only in potash do they appear to be very deficient.

"The average amounts of the several so-called essential plant foods occurring in all muck analyses reported are as follows: Nitrogen, 1.9411 per cent; potash, 0.0443 per cent; phosphoric acid, 0.0897 per cent.

"In some instances the muck soils contain excessive amounts of chlorin in the form of common salt."

Physical effects of lime on soils, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 2, 3, fig. 1*).—Series of zinc cylinders, the bottoms of which were closed with wire gauze, were filled in different cases with clay (80 per cent) and humus (20 per cent), clay (80 and 90 per cent) and lime (10 and 20 per cent), and sand (90, 94, 98, 99, and 99.5 per cent) and lime (0.5, 1, 2, 6, and 10 per cent). These cylinders were placed in water just deep enough to come in contact with the bottom of the soil, and the time required for the water to reach the surface of the soil, the water content of the soil thus moistened by capillarity, and the condition of the soil after drying were noted. The conclusions reached were that lime increases the water capacity of all soils and that it makes clay more pervious and friable and sand closer and more adhesive.

Experiments in capillarity with long tubes, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 4, 5, fig. 1*).—A brief record is given of observations on the rise of water in long tubes filled with loam from different depths (0 to 6, 6 to 12, and 12 to 18 in.) in the soil, and with pure sand, sandy soil, and clay loam. The rapidity of rise of water increased but the percentage of water absorbed decreased with the depth at which samples of loam were taken. The capillary rise was most rapid in the pure sand, but ceased when a height of 26.6 in. above the level of the standing water was reached, this limit being attained in 5 days. The rate of capillary rise in all cases decreased with the height above the level of free water. The fine clay soil absorbed about 35 per cent more water than either of the other samples.

Analyses of waters (*California Sta. Rpt. 1895–1897, pp. 76–102*).—Analyses showing mineral constituents in 16 samples of lake and stream waters, 32 samples of spring waters, and 44 samples of well waters are reported.

Engineer's report on waterworks, A. MARSTON (*Iowa State College Agr. and Mech. Arts Rpt. 1896–97, pp. 39–48, pls. 4*).—An account of the water plant recently constructed at the college.

Soils of San Joaquin Valley Substation, California, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 348–350*).—The character of the strata passed through in boring a 60-foot well is noted. The different soil belts of the region east of Tulare Lake to the Sierra foothills are described and analyses of 3 samples of typical soils are reported. Analyses of an alkali crust and of water from a bored well are also given.

Rocks, clays, coals, plants, and miscellaneous substances (*California Sta. Rpt. 1895–1897, pp. 103–106*).—Analyses of asphalt, sepiolite (meerschaum), shell rock, and concentrated lye, and tests of the behavior of asphaltum bricks at different temperatures are reported, with a list of a large number of rocks, minerals, plants, etc., sent to the station for identification.

Catalogue of the collection of Russian soils, V. V DOKOUCHAYEV (*St. Petersburg, pp. 166; abs. in Selsk. Khoz. i Lyesov., 184 (1897), Mar., p. 714*).—Classified according to different Governments and districts.

The analytical results of the specimens of soils exhibited by the Geological Survey of Japan at the Seventh International Geological Congress, at St. Petersburg, Russia (*Imp. Geol. Survey Japan. Tokio, 1897, pp. 28*).

The most recent works on soils (*Selsk. Khoz. i Lyesov., 187 (1897), Oct., pp. 187–216*).

Variations of soil moisture through May, June, and July, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 5–7, chart 1*).—The results of a series of moisture determinations in a plat of soil during these months, together with the rainfall and average temperature, are shown in a chart.

Soil temperatures (*New York State Sta. Rpt. 1896, pp. 712–717*).—A tabulated summary of tridaily observations during 1896 at depths of from 1 to 18 in.

Analyses of soils, A. K. SABANINE (*Contrib. Agr. Lab. Univ. Moscow, 1896, pp. 47; abs. in Selsk. Khoz. i Lyesov., 185 (1897), Apr., p. 242*).—Analyses of chernozem soils from different localities of Russia indicate that these soils increase in water content, humus, nitrogen, clay, and silt as one proceeds from West to East.—P. FIREMAN.

Examination of soils (*California Sta. Rpt. 1895–1897, pp. 29–37*).—Analyses showing coarse material, fine earth, hygroscopic moisture absorbed at 15° C., moisture and organic matter, humus, nitrogen, and mineral constituents in 2 samples of soil from the Foothill region, 5 from the Great Valley region, and 7 from southern California are reported. A list of soils received for examination is also given.

Examination of soil from Lake Temiscaming, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 7–9*).—The results of mechanical and chemical analyses of a sample of soil from this region are reported and its water capacity, texture, and fertilizer requirements discussed.

Survey of the literature on the culture of moors (*Selsk. Khoz. i Lyesov., 187 (1897), Nov., pp. 413–434*).

FERTILIZERS.

Commercial fertilizers (*Connecticut State Sta. Rpt. 1897, pp. 65–157*).—This includes abstracts of the State laws relating to fertilizers, a list of the manufacturers complying with the provisions of the fertilizer law, a brief summary of the work of fertilizer control in sampling, collecting, and analyzing fertilizers during the year, explanations concerning the analysis and valuation of fertilizers, fertilizer sales in Connecticut, a review of the fertilizer market for the year ending October 31, 1897, by E. H. Jenkins, and tabulated analyses and valuations of

548 samples of fertilizing materials, classified as follows: (1) Raw materials containing nitrogen as the principal ingredient—nitrate of soda, sulphate of ammonia, dried blood, cotton-seed meal, linseed meal, castor pomace, horn, and hoof; (2) raw materials containing phosphoric acid as the principal ingredient—dissolved boneblack and acid phosphate; (3) raw materials containing potash as the principal ingredient—high-grade sulphate of potash, double sulphate of potassium and magnesium, muriate of potash, kainit, and soap boilers' "potash"; (4) raw materials containing nitrogen and phosphoric acid—bone manures, tankage, and dried fish; (5) mixed fertilizers—bone and potash, nitrogenous superphosphates, guanos, special manures, bone and wood ash fertilizer, and home mixtures; (6) miscellaneous fertilizers and manures—cotton-hull ashes, wood ashes, limekiln ashes, lime, tobacco stems, garbage fertilizer, and earth impregnated with sewage.

In the 13 samples of nitrate of soda examined, the percentage of nitrogen varied from 15.02 to 16.27, the cost per pound of nitrogen from 13.7 to 15.6 cts. with an average of 14.6 cts. The cost per pound of nitrogen in 2 samples of sulphate of ammonia was 14.4 cts. "Sulphate of ammonia, which of late years has been too costly to warrant its use as a fertilizer, is not now more expensive than nitrate of soda as a source of nitrogen."

In 65 samples of decorticated cotton-seed meal examined during the year the percentage of nitrogen varied from 6.92 to 8.02, averaging 7.4. The average cost per pound of nitrogen in these samples was 11.6 cts. In one sample of undecorticated cotton-seed meal examined the percentage of nitrogen was 4.48 and its cost per pound 16.4 cts. "Decorticated cotton-seed meal continues to be the cheapest source of quickly available organic nitrogen. Its use is becoming more general in the tobacco growing sections of this State, but it deserves the attention of farmers generally."

The percentages of nitrogen in 2 samples of castor pomace were 4.51 and 4.02, and the cost per pound of nitrogen 18.5 and 21.1 cts., thus showing this fertilizer to be "the most expensive form of organic nitrogen in our market."

Analyses of 7 samples of dissolved boneblack showed a variation in cost per pound of available phosphoric acid of from 5.9 to 6.8 cts., and in 6 samples of dissolved rock phosphate of from 4.4 to 8 cts. "Available phosphoric acid almost invariably costs more in the form of dissolved boneblack than in the form of dissolved rock phosphate," the average price per pound in the former case being about 6½ cts., in the latter 5 cts.

The average cost per ton of the bone manures examined during the year was $29.61; the average station valuation, $28.03, "showing that the station schedule of values for bone has been scarcely lower than is justified by the average selling price of bone."

"The retail cash cost of potash in cents per pound in the various potash salts whose analyses are given . . . [was] as follows:

Retail cash cost per pound of potash in different forms.

	Highest.	Lowest.	Average.
	Cents.	*Cents.*	*Cents.*
In high-grade sulphate	5.5	4.7	5.1
In double sulphate	6.0	4.7	5.7
In muriate	4.5	3.9	4.2
In kainit	5.4	4.8	5.1

"Of the 101 analyses of nitrogenous superphosphates [reported], 20 are below the manufacturers' minimum guarantee in respect of one ingredient and 2 in respect of two ingredients. The number which failed to come up to the guarantee is considerably smaller than in the previous year. The average cost of the nitrogenous superphosphates is $30.44. The average valuation is $20.71, and the percentage difference 46.9."

Of the 100 samples of special manures examined 25 failed to conform to the manufacturers' guarantee as regards one ingredient and 4 were deficient in two ingredients. The discrepancies were specially marked in cases of mixtures of ground bone and chemicals.

"These inequalities are due to the nature of the materials used. It is extremely difficult to uniformly mix dry bone—or some kinds of blood tankage—with fertilizer chemicals, and when once mixed the slight jarring incident to storage and transportation is sufficient to cause considerable mechanical separation of the particles of bone or tankage from the chemicals. Even when a small sample has been very finely pulverized for analysis great care is necessary to avoid this separation of the different ingredients."

The average cost per ton of the special manures examined was $34.34, the station valuation $24.28, and the percentage difference 41.4.

Of 10 samples of home-mixed fertilizers examined, the average cost per ton was $29.16 (including $2 per ton for mixing), and their average valuation on the basis of the station's schedule was $29.07.

[In 55 samples of cotton-hull ashes] the highest percentage of potash was 36.45, the lowest 10.26, while the average percentage was 22.4, slightly lower than the average in the previous year (23.1). Allowing 5½, 5, and 2 cts. per pound, respectively, for water-soluble, citrate-soluble, and insoluble phosphoric acid, the water-soluble potash has cost from 5.1 to 17.6 cts. per pound, or 7.9 per pound on the average.

The percentage of potash [in 20 samples of wood ashes] ranged from 3.44 to 8.60, and that of phosphoric acid from 0.97 to 2.69. Lime has ranged from 27.29 to 50.96, and sand and soil from 5.85 to 20.39. . . . As respects the cost of lime in these ashes, we find that on the average a ton of unleached wood ashes this year has contained 108 lbs. of water-soluble potash, 24 lbs. of phosphoric acid, and 650 of lime. Allowing 5 cts. per pound each for potash and phosphoric acid, the pure lime (calcium oxid) in the 20 samples would cost 57 cts. per 100 lbs., or 10 cts. more per hundred than in limekiln ashes.

The number of fertilizer firms doing business in Connecticut in 1897 was 56; the number of brands offered for sale, 281. There has been no great increase in the number of firms during 15 years (1883–1897), but a decided increase in the number of brands, mainly of special manures.

Composition of the ashes of different woods, R. HARCOURT (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 27–31*).—In continuation of previous work (E. S. R., 9, p. 435), the following analyses of ashes of different woods were made:

Composition of the ash of different kinds of wood and of coal and garbage.

	Potassium oxid.	Sodium oxid.	Phosphoric acid.	Calcium oxid.	Magnesium oxid.	Oxid of iron.	Sulphuric acid.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Hickory	9.17	4.35	2.12	44.43	6.49	0.24	0.56
Rock elm	6.66	2.69	.71	49.52	2.64	.25	.59
Red oak	5.75	1.00	.92	48.97	2.45	.37	Trace.
Butternut	3.99	2.27	1.76	44.95	5.22	.45	.42
Walnut	4.62	....	.70	35.93	5.35	3.42	1.51
Cherry	5.28	.92	1.90	46.93	3.00	1.29	.79
Pear	9.73	Trace.	.81	42.07	3.10	.39	.93
Plum	4.81	Trace.	2.49	48.39	1.89	.22	.63
Peach	6.98	.27	3.43	41.49	3.18	.30	.73
Quince	6.32	1.76	2.29	48.22	3.17	.33	1.07
Grape vine cuttings	12.21	7.67	6.31	21.39	9.96	.44	2.64
Hard coal:							
No. 1	Trace.	Trace.	.15	Trace.	Trace.	5.32	.41
No. 1	Trace.	Trace.	1.12	1.49	Trace.	2.60	.30
Garbage ash	1.27	2.31	1.66	8.13	1.17	5.30	1.40

"The fact that these ashes were pure and prepared from the wood only, explains why the percentages of mineral constituents are so much higher in those found in the average ashes in the market."

Some of the ashes were digested in 1 per cent citric acid[1] with the following results:

Percentages of available potash, phosphoric acid, and lime in different kinds of ashes.

Kind of ashes.	Potassium oxid.	Phosphoric acid.	Calcium oxid.
	Per cent.	*Per cent.*	*Per cent.*
White oak	82.33	....	8.27
Birch	79.48	....	9.89
Mixed ashes	94.92	10.169	11.38
Walnut	99.87	15.57	7.15
Red oak	82.09	....	4.57
Poplar	84.26	2.88	13.50
White ash	90.20	10.32	12.03
Butternut	89.22	....	7.82
Willow	85.40	6.66	8.41

"Nearly 80 per cent of the total potash of the birch ash was found in the solution and practically the whole of that of the walnut ash. An average of the 9 samples experimented with shows that 87.5 per cent of the total potash of the different ashes was soluble in the citric-acid solution. According to this method of determining availability of plant food, all but 12.5 per cent of the potash would be in a form in which growing plants could make use of it at once. Smaller amounts of the phosphoric acid and lime appeared to be soluble. In some cases the amount of phosphoric acid was so small that it was not determined, but simply entered as traces."

Experiments on the availability of fertilizer nitrogen, S. W. JOHNSON, E. H. JENKINS, and W. E. BRITTON (*Connecticut State Sta. Rpt. 1897, pp. 257–277*).—This is a continuation of work of previous

[1] See also Canada Expt. Farms Rpt. 1896, p. 201 (E. S. R., 9, p. 825).

years (E. S. R., 9, p. 540). The apparatus and methods employed were essentially the same as in the earlier experiments, except that the soil used was taken from the field which has been devoted to experiments on the continuous growth of maize on the same land (E. S. R., 9, p. 551). Three series of experiments were undertaken: (1) With oats followed by Hungarian grass; (2) with Hungarian grass; and (3) with rye and oats followed by Hungarian grass. The soil used was a sandy loam on which maize had been grown continuously for 8 years and which had received no fertilizing material of any kind for 6 years. With the exception of nitrate of soda and ground bone, the fertilizing materials used were the same as in the experiments of 1896. At the beginning of the experiment the moisture content of the soil in the pots was kept between 10 and 15 per cent. When the heads first began to appear the quantity of water was increased so that the moisture content of the soil was between 15 and 20 per cent. After the removal of the oat crop (both roots and above-ground part) from the pots, the soil was returned to the pots without further addition of the fertilizers and Hungarian grass was planted. Details as to fertilizers applied and the weight and nitrogen content of the crops produced are given in full in a table. The principal results are summarized as follows:

Percentage availability of different forms of nitrogen in pot experiments with oats and Hungarian grass.

	Experiments in 1897.				Average of experiments, 1894–1896.	Nitrogen availability reckoned on nitrate, 1897.
	1.6 gm. fertilizer.	1.2 gm. fertilizer.	0.8 gm. fertilizer.	Average.		
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Nitrate of soda	(79.6)	(89.3)	102.5	102.5	64	100.0
Dried blood	(65.1)	73.1	77.3	75.2	43	73.3
Dry ground fish	(60.3)	67.3	63.6	65.5	44	63.9
Ground bone	....	18.3	16.1	17.2	....	16.7
Tankage	49.8	48.8	53.4	50.7	38	49.4
Horn and hoof	(68.8)	67.9	72.1	70.0	42	68.3
Linseed meal	(60.4)	68.7	72.4	70.6	45	68.9
Cotton-seed meal	(59.2)	65.1	67.7	66.4	46	64.8
Castor pomace	(59.9)	66.4	66.0	66.2	47	64.6

"It appears that in every case a much larger percentage of the fertilizer nitrogen was taken by the crops in the experiments of 1897, natural soil, than in the previous cultures made in coal ashes and peat. Part of this increase is due to the inclusion of roots with the crops in 1897.

"The percentage availability of nitrogen to the oat crop of 1897 would have been made less by about 12 per cent on the average if the roots had been excluded.

"If we may assume that a like percentage added to the percentage availability as determined in the experiments of 1894, 1895, and 1896 will correctly compensate for the exclusion of the roots in those experiments, it still appears that on the average a larger percentage of nitrogen was assimilated in the experiments of 1897 than in the earlier ones. This is particularly noticeable in the case of nitrate and of dried blood.

"In these experiments of 1897 the nitrogen of raw knuckle bone, ground to pass a sieve with circular holes one-fiftieth of an inch in diameter, had only one-sixth of the availability of the nitrogen of nitrate, one-quarter of that of linseed, cotton seed,

castor pomace, steamed horn and hoof, and fish, and about one-third of that of tankage. The bone used was very dense and hard, unlike most of the ground bone which is sold in our market as a fertilizer, and presumably less readily available. The subject is further discussed in the following paper. . . .

"The nitrogen of tankage (which contains considerable bone, 'bone tankage') has an availability, compared with that of nitrate-nitrogen, of 49 per cent, while the nitrogen of cotton seed, linseed, and castor pomace, as well as that of horn and hoof and in fish, had an availability of from 64 to 69 per cent.

"The experiments of 1897 show but little difference in the availability of nitrogen in cotton seed, linseed, castor pomace, horn and hoof, and fish. In this year the nitrogen of blood had a higher availability than that of the materials just named."

In the second series of experiments (with Hungarian grass) "the apparatus and method, kind and amount of soil, method of mixing and filling, watering and care during growth" were the same as in the above experiments. With the soil of each pot were carefully mixed 50 gm. of carefully precipitated calcium carbonate and 5 gm. of potassium phosphate containing 0.1971 gm. of phosphoric acid and 0.2629 gm. of potash. The nitrogenous materials used were nitrate of soda, cotton-seed meal, and bone in three different grades of fineness ($\frac{1}{150}$ in., $\frac{1}{50}$ in., and $\frac{1}{25}$ in.). Detailed data are given in a table. The principal results may be summarized as follows:

Percentage availability of different forms of nitrogen in pot experiments with Hungarian grass.

	Experiments in 1897.				Nitrogen availability reckoned on nitrate.
	1.6 gm. fertilizer.	1.2 gm. fertilizer.	0.8 gm. fertilizer.	Average.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Nitrate of soda	a 74.6	95.3	95.2	95.3	100.0
Cotton-seed meal	58.1	53.3	54.3	55.2	57.9
Bone, grade A	10.5	12.0	9.9	10.8	11.3
Bone, grade B	7.0	6.9	10.4	8.1	8.5
Bone, grade C	3.9	6.2	5.9	5.3	5.6

a Excluded from the average.

"It thus appears that in these cultures, while 95.3 per cent of the nitrogen of nitrate of soda and 57.9 per cent of that of cotton-seed meal were taken up by the crop, under similar conditions, only 11.3 per cent of the nitrogen of the finest bone flour was taken by the crops and still less than that percentage from coarser grades.

"These figures do not indicate that the nitrogen of bone is always or generally inferior to that of other animal and vegetable materials.

"Bone finds its most profitable use on crops like grass and clover, which are not annuals, but whose roots occupy the soil through the whole year and are more or less active at all seasons.

"The best grass lands, too, are loams inclined to be heavy or clayey rather than sandy and, in consequence, retentive of moisture. On such soils it is very likely that bone decomposes more rapidly than in the sandy loam of our experiment and the perennial roots of the crops named would certainly be more efficient in taking up the nitrogen of fertilizers than those of the short-lived plants (oats and Hungarian grass) used in our experiments. It should also be noted that the bone used by us was of the hardest kind, such as is used for the manufacture of 'ivory' goods, which is presumably more slowly decomposed and dissolved in the soil than other sorts."

In case of the third series of experiments (rye and oats followed by Hungarian grass), the crops were greatly damaged by excessive rains and the results are withheld from publication.

Improvement and fertilization of land, E. W. HILGARD (*California Sta. Rpt. 1895–1897, pp. 107–111*).—A brief discussion of the fertilizer requirements of plants and the use of fertilizers, especially on California soils; suggestions regarding fertilizer experiments; and analyses of 15 samples of fertilizing materials, including gypsum, dust from sheep fleeces, phosphate, soil from Indian burial ground, guano, clay, shell rock, lime refuse, and waste water from sugar-beet factories.

Survey of the most recent literature on the fertilizing of the soil (*Selsk. Khoz. i Lyesov., 187 (1897), Dec., pp. 605–624*).

General considerations relating to the valuation of fertilizers, H. VANDERYST (*Rev. Gén. Agron., 1898, Nos. 2, pp. 80–88; 4, pp. 184–190; 5, pp. 226–239*).

Farm manure and denitrification, R. WARINGTON (*Ann. Agron., 24 (1898), No. 4, pp. 145–171*).—This is a French translation by E. Demoussy of an article which appeared first in Jour. Roy. Agr. Soc., 3. ser., 8 (1897), pt. iv, pp. 577–607 (E. S. R., 9, p. 933).

On the nitrogen feeding of phanerogamous plants by means of amins, ammonium compounds, and alkaloids, L. LUTZ (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 17, pp. 1227–1229*).

The origin of the nitrate of soda of Chile, W. NEWTON (*Ann. Sci. Agron., 1898, I, No. 1, pp. 40–45*).—A discussion of the theories of the formation of the nitrate deposits.

Nitrate of soda and perchlorate of potash—remarks on certain failures with rye, L. GRANDEAU (*Ann. Sci. Agron., 1898, I, No. 1, pp. 84–91*).—A discussion of this subject based principally upon the observations of Sjollema, Wagner, and Stutzer.

Report on injuries caused by the use of nitrate of soda in the spring of 1896, M. CRISPO (*Ann. Sci. Agron., 1898, I, No, 1, pp. 92–120*).

Investigations on the action of ammonium sulphate and nitrate of soda, E. KLOEPFER (*Essen: G. D. Baedeker, 1898, pp. 59, ill.*).

The production of potash (potassium carbonate) from ashes. Practical guide for the preparation of potash from trees and grasses, P. PHEDOTYEV (*St. Petersburg, 1896, pp. 42; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Oct., p. 235*).

Provisions of the new fertilizer law of New York, L. L. VAN SLYKE ET AL. (*New York State Sta. Rpt. 1896, pp. 125–137, pl. 1*).—Reprint of Bulletin 103 of the station (E. S. R., 8, p. 212).

Report of analyses of commercial fertilizers for the spring of 1896, L. L. VAN SLYKE ET AL. (*New York State Sta. Rpt. 1896, pp. 138–203*).—Reprint of Bulletin 107 of the station (E. S. R., 8, p. 766).

Report of analyses of commercial fertilizers for the fall of 1896, L. L. VAN SLYKE ET AL. (*New York State Sta. Rpt. 1896, pp. 204–261*).—Reprint of Bulletin 116 of the station (E. S. R., 9, p. 122).

The real value of natural plant food, L. L. VAN SLYKE (*New York State Sta. Rpt. 1896, pp. 119–124*).—A reprint of Bulletin 108 of the station (E. S. R., 8, p. 766).

Alkali, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 350–352*).—The rise of alkali in the experimental fields of the San Joaquin Valley Substation is discussed and experiments with gypsum for correcting alkali are reported. When this substation was first established alkali did not show, except in three or four spots on the experimental field, but as cultivation has proceeded the rise and spread of the alkali has been very rapid. Gypsum, in connection with irrigation and underdraining, has given good results in correcting the alkali.

FIELD CROPS.

Report of the agricultural department, W. C. LATTA (*Indiana Sta. Rpt. 1897, pp. 51-59*).—In this report the work of the year is outlined and the results of the experiments briefly summarized. The work is largely a continuation of former experiments (E. S. R., 9, p. 347). Among 13 varieties of wheat, Russian, Michigan Amber, Velvet Chaff, and Bearded Winter Fife, and among 21 varieties of oats, White Russian, White Swede, and Black Prolific, were the most promising varieties.

A test of fertilizers on oats was made on two series of plats, one of which had produced crops in a regular rotation, while the other had grown grain crops for the same length of time. There were 10 plats in each series, including 3 check plats which had received no fertilizer. Acidulated phosphates, nitrate of soda, and muriate of potash were applied in different quantities. On the plats which had been in the rotation the best yield (68.12 bu. per acre) was produced by the application of 125 lbs. acidulated phosphate, 37½ lbs. nitrate of soda, and 15 lbs. muriate of potash per acre, but the yields of the check plats were 48.19 bu. per acre for the first, 53.28 bu. for the second, and 68.28 bu. for the third. On the series of plats which had produced grain continuously, the best yield was 68.91 bu. per acre, which was obtained from the plat fertilized with 145 lbs. acid phosphate, 75 lbs. nitrate of soda, and 15 lbs. muriate of potash per acre. The yield from the check plats in this series varied from 50.78 to 53.90 bu. per acre.

Cultivating corn 1 and 3 in. deep gave better yields than cultivating 2 and 4 in. deep. The average results for 9 years have been in favor of cultivating 1 in. deep.

From the results of the experiments it is concluded unwise to attempt the growing of winter oats in that latitude. Notes are given on grasses, clovers, and forage crops, and experiments on previous manuring on the yield of corn, heavy and light applications of manure and fertilizer, and continuous growing of clover, as yet incomplete, are described.

Chicory growing as an addition to the resources of the American farmer, M. G. KAINS (*U. S. Dept. Agr., Division of Botany Bul. 19, pp. 52, figs. 12*).—This bulletin describes the chicory plant and its uses and gives directions for growing the crop for the root and for fodder. Details of the preparation of the soil, sowing, cultivation, and storing the crop, statistics on the importation of chicory since 1869, and analyses of the raw and roasted root are given. Three varieties, Brunswick, Magdeburg, and Schlesische, considered the best known kinds used in America for roasting, are described.

The results of experiments in the germination of seeds from early and late chicory flowers and of large and small seeds are reported in tables. "The ratio of good to poor seed in individual flower heads proved, in all cases examined, to be in favor of the early flowers."

Weight and germination of large and small seeds.

Large seed.							Small seed.						
Weight of 100 seeds sown.	Days.						Weight of 100 seeds sown.	Days.					
	2	3	5	9	15	21		2	3	5	9	15	21
Mg.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Mg.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
226.14	13	28	59	75	86	91	81.20	6	11	25	39	46	51
208.16	9	22	49	68	79	85	81.20	4	9	17	24	30	33
207.02	11	23	50	71	83	88	80.00	3	8	18	26	31	33
190.09	8	19	40	63	74	81	79.84	4	7	14	20	23	26
114.00	5	13	29	49	58	63	81.05	2	5	10	15	17	19

"Not only was the percentage of germination in favor of the large seeds . . . but the time required to get a fairly good stand was also much less."

Experiments with field roots, silage, and forage crops, C. A. Zavitz (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 186–213*).—This work consisted of variety tests, distance experiments, and selection of seed with a number of different crops. All results are tabulated. Work in this line has been formerly reported (E. S. R., 9, pp. 440, 443).

Swedish turnips.—In a test of 79 varieties planted 10 in. apart in rows $26\frac{2}{5}$ in. apart, Improved Long Island and Dreer Improved Purple Top produced the heaviest roots. Improved Long Island, Laidlaw Improved, and Dreer Improved Purple Top produced the largest yields of roots (29.25, 28.25, and 27.85 tons per acre, respectively.) Of 29 varieties tested for 9 years Hartley Bronze Top heads the list in productiveness with an average yield of 21.11 tons of roots per acre. From the results of experiments conducted for 6 years in succession the general conclusion is drawn that as the distance between plants in the row increased from 8 to 20 in., the average yield decreased, but the average weight per root increased. The average yield of plants 4 and 8 in. apart was 17.26 and 17.58 tons of root per acre, respectively. The average results for 6 years showed that drills 20 in. apart gave a better yield than drills 26 and 32 in. apart.

Fall turnips.—On the average of 7 years' experiments Jersey Navet, Graystone Improved Purple Top Mammoth, and Early American Purple Top, in the order given, produced the heaviest roots. Thinning the plants to 4 in. apart in rows $26\frac{2}{5}$ in. apart gave a better average result for 6 years than thinning to 8, 12, 16, or 20 in. apart. A test of different distances between drills with plants 10 in. apart in the drill proved 20 in. to be preferable to 26 or 32 in.

Mangel-wurzels.—This season 62 varieties were tested. Among 27 varieties grown for 7 years Evans Improved Mammoth Sawlog produced the largest average yield, 25.17 tons per acre, followed by Simmer Improved Mammoth Long Red with 25.11 tons and Steel Long Red Selected with 24.24 tons per acre. Four inches between roots in drills $26\frac{2}{5}$ in. apart and 20 in. between drills with 10 in. between plants in the drill proved to be the preferable distances. The average weight of the

roots thinned to 20 in. apart was over 5 lbs., while that of those 4 in. apart was only a little over 1 lb.

Sugar beets.—Lane Improved, White Silesian, Red Top, Champion, White French, and Kleinwanzlebener, named in the order of their productiveness, yielded on the average for 6 years over 15 tons per acre. The average yield for Lane Improved was 19.07 tons per acre.

In experiments with mangels, carrots, sugar beets, Swedish turnips, and fall turnips it was found that planting the seed 1 in. deep gave better results than planting 2, 3, or 4 in. deep, and that large, plump seed gave better yields than medium or small seed. Thinning mangels, carrots, and Swedish and fall turnips, when the plants were from 1½ to 2 in. high, gave better results than thinning when the plants were from 8 to 10 in. high. Slightly better yields were obtained with flat cultivation than with ridged cultivation. Tests were made of 18 varieties of millet, 3 of sunflower, 20 of grass, and a number of varieties of rape, kale, clover, and other miscellaneous crops.

Experiments with varieties of grain, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 154–186*).—These experiments are along the lines of work reported in previous years (E. S. R., 9, p. 440). All varieties of different crops obtainable in Canada and the leading varieties from the United States and various countries in Europe, Asia, Africa, and Australia were tested, and some excellent foreign varieties have been obtained. Other features, such as method and time of sowing, selection of seed, time of harvesting, etc., were studied in connection with this work. The results for 1897 and the average results for the number of years the varieties were grown are given in tables. All plats were $\frac{1}{100}$ acre in size.

Barley.—Fifteen six-rowed, 19 two-rowed, and 12 hulless varieties were on trial. The seed was sown broadcast April 28 at the rate of 100 lbs. per acre. Oderbrucker, Scotch Improved, Jarman Selected Beardless, and Manitoba six-rowed produced the heaviest grain, the weight per measured bushel varying from 51.1 to 51.9 lbs. Oderbrucker weighed about 53.25 lbs. on an average for 9 years. Taking the average results, Mandscheuri and Oderbrucker were the most productive varieties tested. The average yield of Mandscheuri for 9 years was 63.6 bu. per acre, while the yield of Oderbrucker was 55.92 bu. The average weight per measured bushel of Mandscheuri for the same period is about 2½ lbs. less than that of Oderbrucker. The average yield for this season was 38.3 bu. for the six-rowed varieties and 38.8 for the two-rowed varieties. Among the hulless varieties in the average for the number of years they were grown Black Hulless, Three-rowed, Guyamala, and Purple have yielded grain weighing over 60 lbs. per measured bushel, this weight being taken as the standard. Black Hulless yielded the best average for 8 years, 38.17 bu. per acre. An experiment in broadcasting and drilling on different dates resulted in the largest yield from barley drilled April 19.

Peas.—Forty-seven varieties of peas were sown in drills 1 link apart. The yields varied from 14.55 bu. to 33.1 bu. per acre. Chancellor matured first and Oakshott Field last, there being a difference of 24 days in the ripening period of the 2 varieties. The best average yields for 7 years ranged from 33.36 to 38.04 bu. per acre and were produced by White Wonder, Early Briton, Field, Mummy, Brown, and Blue, in the order given. All excepting Early Briton and Mummy are New Zealand varieties. In general, during a two-years' test, drilling gave better results than broadcasting. Sowing on different dates resulted in the highest average yield from the seeding made April 22 as compared with earlier and later dates.

Spring wheat.—Tests were made of 48 varieties. Bart Tremenia, Wild Goose, Medeah, Sorentina, and Algiers were the most productive of the coarse-grained wheats and Herison Bearded, Saxonka, Konisburg, Red Fern, Red Fife, Colorado, Rio Grande, Washington, Wellman Fife, and Blue Democrat among the fine-grained varieties. Herison Bearded in 9 years' trials has given an average yield of 26.5 bu. per acre, at an average weight of 62⅓ lbs. per measured bushel. In general, broadcasting gave better results than drilling. The first seeding of wheat, made April 19, gave a better yield than the later ones. As the time of seeding advanced the crop decreased in quantity and quality.

Winter wheat.—A test of 91 varieties was made on 189 plats. Early Red Clawson, Golden Drop, Early Genesee Giant, Imperial Amber, Dawson Golden Chaff, Tuscan Island, and Egyptian, in the order given, produced the largest yield. These varieties also stand first in productiveness among 86 varieties grown for 4 years in succession. Dawson Golden Chaff has given a yield of 50.5 bu. per acre in the average of 6 years' tests.

For 5 years winter wheat has been sown on September 3, 9, and 20. This season's sowing (September 9) gave the best results, but the average for the whole period is in favor of the earlier date. The results from drilling and broadcasting the seed were very similar in this year's test, as well as in the average for 4 years. Sowing seed at the rate of 2 bu. per acre gave better results than sowing at the rate of 1½ and 1 bu. per acre. An experiment in the selection of seed resulted in the best yield from the large plump seed as compared with small plump, shrunken, or cracked seed. The use of sprouted grain for seed showed that sprouting impairs the germinating power and tends to produce an uneven crop.

On 12 plats, each 1 rod wide by 6 rods long, the soil was given different treatment previous to sowing. The experiment was duplicated, there being 6 plats in each set. These plats were plowed in the fall of 1895 and received surface cultivation the following spring. Four plats of each set were sown to oats, buckwheat, rape, and clover, and the other two were worked as bare summer fallow. The green crops were plowed under about August 1 and barnyard manure at the rate of 20

tons per acre was applied to one of the bare fallow plats in each set. The wheat was sown August 25. The bare fallow plats which had received the barnyard manure produced the heaviest yield, but the method of treatment was also the most expensive. Green manuring with peas was more effective than green manuring with rape or buckwheat or bare summer fallow without barnyard manure.

A study was made of the effect of cutting at different stages of maturity, the average dates of cutting for 4 years being July 4, 11, 18, 25, and August 1. In each year the greatest yield of straw was obtained from the first cutting, the heaviest grain per measured bushel from either the second or third cutting. The lowest yields and the lightest grain were obtained from the first cutting of each variety in each year. The best average yield for 4 years was obtained from the cutting made July 25.

Oats.—Comparative tests of 103 varieties were made. In general the varieties with a spreading head gave most satisfactory results. Joanette, a black variety, has given the largest average yield of grain among all the varieties tested, 86.08 bu. per acre. But few of the black varieties rank high in productiveness. Siberian, Oderbrucker, Waterloo, Probsteier, and Danebrog, all of which are white varieties, gave an average yield of over 75 bu. per acre in a 9-year test. The results in favor of the drilled grain as compared with grain sown broadcast were more marked than in the case of some of the other crops. Oats sown April 22 gave a larger yield this season than seed sown earlier or later, and this was true for the average of 3 years.

Beans.—Among 31 varieties White Wonder, Burlingame Medium, Medium, Schofield, and Snowflake, in the order named, were most productive, their yields ranging from 31.47 to 36.77 bu. per acre.

Mixed grain.—Eleven different combinations of barley, peas, oats, and wheat were tested for the production of grain and straw. Barley, peas, and wheat gave the best yield of grain and barley and peas the largest yield of straw for this season, but the best average yield in straw and grain for 5 years was produced by a mixture of barley and oats.

Seed selection.—Different qualities of seed of barley, spring wheat, white oats, and peas were selected and tested. In a 3-year trial with barley, wheat, and oats, in every case except two large plump seed produced the largest kernel as compared with small plump and shrunken seed.

Dark-colored plump, light colored and light weight, and hulled grain of Joanette oats were selected and compared. The light seed produced the smallest grain, the hulled seed the next smallest, and the large plump the largest and heaviest grain. Sound peas for seed gave better results than cracked peas, and large peas better yields than small ones.

Tests of 3 varieties each of spring rye and buckwheat are reported.

Sugar beets in Colorado in 1897, W. W. COOKE and W. P. HEADDEN (*Colorado Sta. Bul. 42, pp. 1–38*).—This bulletin gives the report

of cooperative culture experiments with sugar beets in 1897. Chemical analyses of soils from five different sections of the State and instructions for the growing of sugar beets are given. The results are tabulated in detail and sugar-beet culture is discussed in general. From the results obtained it is concluded that good sugar beets can be raised in any part of Colorado which is adapted to any kind of farming, and that large crops of good beets can be grown in districts supplied with water for irrigation. The length of the campaign for the State is estimated at 120 days. The ripe crop of beets in 1897 averaged 15.5 per cent of sugar and 81.6 per cent purity. The average yield per acre was about 16 tons.

Influence of drying on beets (pp. 29–31).—On October 29 beets were taken from the field and divided into 3 equal lots: Lot 1 was kept for a day in a cool, dark place; lot 2 was left for a day in the open field; and lot 3 was piled up and covered with a few inches of dirt and left in the field for 5 weeks. The analyses gave the following results:

Influence of drying on beets.

	Treatment.	Sugar content.	Purity.
		Per cent.	*Per cent.*
Lot 1	Kept for a day in a cool place	14.0	82
Lot 2	Kept for a day in the open field	14.9	79
Lot 3	Kept for 5 weeks in the field	14.7	84

Lots 2 and 3 lost weight by drying out, but no fermentation of the sugar in the beet took place. It was found that green beets when left to dry sustain a loss of sugar by fermentation.

Influence of freezing on beets (p. 31).—Two beets, one slightly, the other decidedly frozen, were divided into three parts by weight and each third analyzed to ascertain the effect of freezing. Of the beet described as decidedly frozen, the upper third was all frozen, the middle third partly frozen, while the lower portion was left uninjured. The following table gives the results:

Effect of freezing on sugar beets.

	Sample partly frozen.		Sample decidedly frozen.	
	Sugar.	Purity.	Sugar.	Purity.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Upper third	12.9	78.7	10.9	73.2
Middle third	12.0	91.1	11.2	70.3
Bottom third	12.0	81.4	14.3	88.3

Sugar-beet growing in Iowa, 1897, C. F. CURTISS and J. ATKINSON (*Iowa Sta. Bul. 37, pp. 20, fig. 1*).—This is a popular bulletin on sugar-beet culture, giving the results of culture experiments at the station and throughout the State. Results are given in a table.

The average sugar content of 663 samples obtained from the cooperative tests was 13.07 per cent, with an average coefficient of purity of 77.4. The samples harvested earliest were poor in quality, while those harvested later made a better showing as the season advanced. This was also found to be the case in the experiments at the station. Six varieties were tested at the station, each variety being grown on six different plats under varying conditions. The results are given in the following table:

Average results of variety tests of sugar beets.

Name.	Sugar.	Purity.
	Per cent.	*Per cent.*
Schreiber	15.09	83.23
Original Kleinwanzleben	14.72	82.62
Dramez Elite	14.30	81.60
Zieman	13.90	79.72
Dippe	13.83	78.81
Vilmorin	13.32	80.11

Experiments in the fertilizing and curing of tobacco, 1897, E. H. JENKINS (*Connecticut State Sta. Rpt. 1897, pp. 223–230*).—A series of fertilizer experiments were begun to compare the effect of barnyard manure and commercial fertilizers—a mixture of barnyard manure and commercial fertilizers, and green manuring with a leguminous crops—on the quality of the leaf. The crop was harvested and was undergoing curing by artificial heat when it was destroyed by fire.

A note is given on the process of pole-curing, and the work of curing the crop so far as completed is fully described. The temperature of the curing barn was never higher than 88° F. and seldom over 82°, and was kept as nearly uniform as possible throughout the building. The author cautions against chilling tobacco by low temperatures and allowing it to become dry before it has come to color and against curing it irregularly.

Experiments in growing tobacco with different fertilizers—report on the fermented crops of 1896, E. H. JENKINS (*Connecticut State Sta. Rpt. 1897, pp. 230–243*).—This report is the conclusion of experiments begun in 1892 and completed in 1896, some of the results obtained in these tests having been previously reported (E. S. R., 9, p. 543). The details of expert judgment on each lot of tobacco from the experimental plats in 1896 are given. The average results obtained by fermentation and the relative quality of the leaf from the different plats, taking the entire period into consideration, are reported below.

Results of the experiments with tobacco fertilizers for the years 1892 to 1896, E. H. JENKINS (*Connecticut State Sta. Rpt. 1897, pp. 243–256*).—The results of these experiments and the manner in which they were conducted are discussed in a previous report of the station (E. R. S., 9, p. 543) and are here briefly summarized, with the

additional facts brought out by the fermentation of the crop of 1896. The effect of fermentation on the weight and fire-holding capacity of tobacco is shown in the following table, which gives the averages of all the plats under experiment:

Average weight and fire-holding capacity of wrapper leaves.

	Average number of wrapper leaves per pound.		Average fire-holding capacity in seconds.	
	Before fermentation.	After fermentation.	Before fermentation.	After fermentation.
Short wrappers	87	92	12.0	28.5
Long wrappers	64	68	9.2	23.9

The long and short wrappers in the sorted crops averaged 60.7 per cent, some plats yielding as high as 78 per cent of wrappers. The average yield per acre of pole-cured, sorted tobacco for all the plats was 1,685 lbs., the maximum being 2,280 lbs. and the minimum 1,145 lbs. per acre. The average loss of weight in sorting ranged from 4.5 to 5.3 per cent. The following table shows the comparative value of the leaf from the several plats. The number expressing the relative quality is the average of the numbers representing the grading of the tobacco for each year, the smaller numbers representing the higher values:

Comparative value of the leaf from all the plats for five years.

Plat.	Fertilizers applied.	Relative quality.
P	Cotton-seed meal, double carbonate of potash and magnesia, and bone	6.0
Y	Cotton-seed meal and wood ashes	7.2
Z	Ground fish, double sulphate of potash and magnesia, and bone	7.5
B	Linseed meal and cotton-hull ashes	7.8
W	Mapes tobacco manure	8.4
AA	Stable manure	8.5
H	Castor pomace and cotton-hull ashes	9.6
F	Linseed meal, cotton-hull ashes, and bone	10.3
C	Cotton-seed meal and cotton-hull ashes	10.4
O	Cotton-seed meal, carbonate of potash, and bone	11.0
D	Cotton-seed meal and cotton-hull ashes	11.4
J	Castor pomace and cotton-hull ashes	12.6
K	Cotton-seed meal, double sulphate of potash and magnesia, and bone	13.4
S	Stockbridge tobacco manure	13.6
U	Mapes tobacco manure	14.0
G	Castor pomace and cotton-hull ashes	15.0
A	Cotton-seed meal and cotton-hull ashes	15.6
V	Mapes tobacco manure and Mapes starter	15.6
I	Castor pomace, cotton-hull ashes, and nitrate of soda	16.0
BB	Tobacco stems	16.0
L	Cotton-seed meal, double sulphate of potash and magnesia, and bone	16.6
R	Stockbridge tobacco manure	17.8
N	Cotton-seed meal, sulphate of potash, and bone	19.8
X	Sanderson tobacco manure	21.4
Q	Baker tobacco manure	23.0
E	Castor pomace and cotton-hull ashes	24.0
M	Cotton-seed meal, sulphate of potash, and bone	24.4
T	Ground fish, nitrate of soda, and lime	25.5

The discussion of the results is practically the same as that given in the previous report (E. S. R., 9, p. 543).

Report of the farm superintendent, W. RENNIE (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 215–217*).—Notes on the different crops grown in 1897.

Superphosphate as a fertilizer for barley, M. ULLMANN (*Deut. Landw. Presse, 25 (1898), No. 14, p. 145*).—The results of experiments show that water-soluble superphosphate as a fertilizer produced a better yield and a better quality of barley than citrate-soluble superphosphate.

Analyses of cañaigre or tanners' dock, G. E. COLBY (*California Sta. Rpt. 1895–1897, pp. 186–190*).—A table is given showing the results of 82 analyses of cañaigre root, comprising all the results obtained at the station up to July, 1897. This is work in continuation of that already reported (E. S. R., 8, p. 686). The average of 30 analyses of California-grown cañaigre roots one year old was 27.7 per cent of tannin in the air-dried substance.

Harvest of flax and hemp seed in Russia during 1897, W. R. HOLLOWAY (*U. S. Consular Rpts. 1898, No. 213, pp. 259, 260*).—The amount of flaxseed harvested was 727,920 tons, being 28.5 per cent less than the crop of 1896. The amount of hemp seed produced was 316,800 tons, which was nearly 25 per cent less than the crop produced the previous year.

Silage and silos, W. P. WHEELER (*New York State Sta. Rpt. 1896, pp. 641–656, pls. 2*).—A reprint of Bulletin 102 of the station (E. S. R., 8, p. 222).

Report of grasses and fodder plants, A. B. LECKENBY (*California Sta. Rpt. 1895–1897, pp. 298–301*).—Brief notes on culture tests in southern California of plants "that offer special promise of usefulness as wild feed or have a direct bearing as a farm crop." The following crops were tested: Australian saltbush (*Atriplex semibaccata*), modiola (*Modiola decumbens*), sapling clover (*Trifolium medium*), common white clover (*T. repens*), black medic (*Medicago lupulina*), hairy vetch (*Vicia villosa*), sheep purslane (*Portulaca oleracea*), awnless and Schrader brome grasses (*Bromus inermis* and *B. unioloides*), orchard grass (*Dactylis glomerata*), Italian rye grass (*Lolium multiflorum italicum*), tall oat grass (*Arrhenatherum elatius*), small fescue (*Festuca elatior pratensis*), *Eleusine barcinonensis*, prolific panic grass (*Panicum proliferum*), pearl millet (*Pennisetum typhoideum*), Abyssinian feather grass (*P. longistylum*), teosinte (*Euchlæna luxurians*), Bermuda grass (*Capriola dactylon*), squirrel tail (*Hordeum jubatum*), ragi (*Eleusine coracana*), redtop (*Agrostis vulgaris*), fiorin grass (*A. alba*), barnyard grass (*Panicum crus-galli*), knot grass (*Paspalum distichum*), sheep fescue (*Festuca ovina*), rough meadow grass (*Poa trivialis*), annual poa (*P. annua*), and meadow soft grass (*Holcus lanatus*).

Some economic plants, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 339, 340*).—Notes on crops of cañaigre, licorice, pyrethrum, cereals, and forage plants. Among the collection of varieties of wheat, Royal Australian was the best milling variety. The leading wheats among the varieties tested are given. Of the grasses tested for 6 years, Hungarian brome grass kept green in summer better than any other. Red clover and white clover were found to grow well in the rainy season and during the spring, but to fail later on when left unirrigated. Bokhara clover remained green during the summer without irrigation for several successive years. "Esparcet keeps green during the dry season. It is valuable for this district, and succeeds far better on the light and shallow soil than on the heavier." The species succeeding best on the heavy soils of the swale were *Agropyron japonicum*, *Bromis inermis*, *Digitaria sanguinalis*, *Holcus lanatus*, *Lolium perenne*, *Agrostis vulgaris*, *Euchlæna luxurians*, *Phalaris media*, *P. canariensis*, *Lotus tetragonolobus*, and *Melilotus alba*.

Small culture plats, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 384–389*).—Notes on small culture tests with saltbushes, cotton, grasses, sorghum, sunflowers, and legumes. The crops were grown on a 10-acre tract of alkali soil. Of the low-growing species of saltbush *Atriplex semibaccata* was found to be the best. Among the grasses *Bromus unioloides*, *Eleusine coracana*, and *Lolium perenne italicum* made a good growth, but the different species of Festucas, Poas, and Panicums were failures. Sunflowers and Jerusalem artichokes grew well on the alkali soils, but legumes were not successful. The tract was divided into separate plats. The alkali content and notes on the crop of each plat are given.

Notes on small cultures, A. V. Stubenrauch (*California Sta. Rpt. 1895–1897, pp. 340–343*).—Notes on experiments with tobacco, sugar beets, Australian saltbush, kale, and sorghums. Thirty-five varieties of tobacco were tested, and from results it is concluded "that the plant will thrive and grow through the hot summers, and . . . that of the long list of desirable varieties under cultivation some will . . . produce tobacco of a marketable quality."

Among the varieties of kale Dwarf German Greens made the best growth. "Wind or heat did not seem to affect it at all, nor did it receive any water during the summer."

Three varieties of sorghum, Safed Juar, Dewala, and Baedra peela, planted May 5, produced no seed during the season.

Report on grasses and forage plants, E. J. Wickson (*California Sta. Rpt. 1895–1897, pp. 271–292, pl. 1, figs. 4*).—The early introduction of grasses and forage plants into California is discussed and later introductions of grasses, legumes, and miscellaneous fodder plants are noted. Concise reports of cooperative culture tests and descriptions of the following crops are given: Many-flowered millet grass (*Oryzopsis miliacea*), Schrader brome grass (*Bromus unioloides*), Japanese wheat grass (*Agropyron japonicum*), Texas blue grass (*Poa arachnifera*), tall oat grass (*Arrhenatherum elatius*), Hungarian or awnless brome grass (*Bromus inermis*), snail clover (*Medicago turbinata*), square pod pea (*Lotus tetragonolobus*), flat pea (*Lathyrus sylvestris*), tagasaste (*Cytisus proliferus albus*), sachaline (*Polygonum sachalinense*), Nepaul barley, and Jersey kale.

Culture experiments with different varieties of saltbush on alkali soils are briefly described.

Notes on hay growing, C. H. Shinn (*California Sta. Rpt. 1895–1897, pp. 324, 325*).—Short notes on the results of growing barley for hay during two seasons. The barley was sown at different intervals from October to February in both years. The crops were cut for hay in May and June. The effects of fertilizer applications are reported.

Jamaica hay, B. S. C. Heaven (*Jour. Jamaica Agr. Soc., 2 (1898), No. 7, pp. 278–281*).—A discussion on the preparation of hay from guinea grass. The food value of this hay and timothy are compared.

A few observations on Paspalum dilatatum, H. M. Williams (*Agr. Gaz. New South Wales, 9 (1898), pt. 5, pp. 507–509*).—The grass is highly recommended for permanent pasture and is considered one of the best for general purposes. "It has proved itself a mainstay for . . . stock, growing vigorously when the fierce heat had withered up the other grasses."

The cultivated vetches, J. G. Smith (*U. S. Dept. Agr., Division of Agrostology Circ. 6, pp. 8, figs. 6*).—A revised edition (E. S. R., 10, p. 43), in which notes on Dakota vetch (*Lotus americanus*) and bird vetch (*Vicia cracca*) have been added.

The application of commercial fertilizers to spring grains, Emmerling (*Fühling's Landw. Ztg., 47 (1898), No. 8, pp. 310–312*).—A discussion with special reference to fertilizers furnishing phosphoric acid and their effect upon the soil and crop.

Phosphoric acid and the cereals, C. Guffroy (*Jour. Agr. Prat., 2 (1898), No. 28, pp. 52–54, figs. 2*).—Phosphoric acid was applied to wheat and barley at the rate of 500 kg. per hectare. Disregarding the yield, the author concluded from the results that phosphoric acid as a fertilizer for cereals increases the diameter and length of the stem and in general the rigidity of the plant, improves the development of the head, and increases the specific gravity of the grain.

The sorting of grain and the modern utensils for the purpose, von Rümker (*Fühling's Landw. Ztg., 47 (1898), No. 8, pp. 307–310, figs. 2*).—The importance of the specific gravity, size, and form of seeds of cereals is pointed out and methods of sorting the grain described.

The cultivation of potatoes in European Russia (*Rpt. Min. Agr. and Govt. Estates, Div. Rural Econ. and Agr. Stat. St. Petersburg, 1897, pp. VI+162+152; abs. in Selsk. Khoz. i Lyesov., 186 (1897), Sept., p. 712*).—The first part of this report contains general information about potatoes; the second part contains descriptions of the culture of potatoes in different Governments.—P. FIREMAN.

Economy in using fertilizers for raising potatoes (*New York State Sta. Rpt. 1896, pp. 107–118*).—A reprint of Bulletin 112 of the station (E. S. R., 9, p. 128).

Sisal culture in Mexico, M. GÉNIN (*Bul. [Min. Agr. France] 17 (1898), No. 1, pp. 215–228, figs. 3*).

Sugar beets, M. E. JAFFA (*California Sta. Rpt. 1895–1897, pp. 125–141*).—A report is given of analyses of samples received during the seasons of 1895 and 1896 from cooperative culture experiments made by farmers and the experiment substations. Culture tests made by farmers are grouped by counties. The details of all tests are given in notes and tables.

Analyses of sugar beets, R. HARCOURT (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 25–27*).—Results of cooperative experiments.

Growing sugar beets for factories, G. H. WEST (*Colorado Sta. Bul. 42, pp. 39–64, fig. 1*).—A number of beet-sugar factories are described and notes are given on labor, factory customs and requirements, machines used in beet culture, the cost of making sugar, and the value of sugar beets and beet pulp for feeding purposes.

Sugar beets, C. F. CURTISS (*Iowa Agr. Col. Rpt. 1896–97, pp. 105–111*).—A partial reprint of Bulletin 37 of the station (see p. 241).

Planting sugar beets, C. D. SMITH and R. C. KEDZIE (*Michigan Sta. Spec. Bul. 8, pp. 4*).—Popular directions for growing sugar beets.

Cooperative sugar-beet work (*Nebraska Sta. Rpt. 1897, pp. 23–26*).—A short report on the arrangement of the cooperative experiments conducted and the results obtained. The average sugar content of the juice of 106 samples of beets from 36 counties was 12.34 per cent, with a purity of 75 per cent. The highest percentage of sugar in juice was 16.8, with a purity of 78.5, and the lowest 4.67, with a purity of 45 per cent.

Sugar beets, C. T. JORDAN (*New Mexico Sta. Bul. 23, pp. 55–67*).—General directions for sugar-beet culture and instructions for taking samples for analysis are given.

Tobacco (*Jour. Jamaica Agr. Soc., 2 (1898), No. 7, p. 294*).—Directions for two methods of preparing beds for sowing tobacco seed are given.

Tobacco growing in Pennsylvania in 1897, F. R. DIFFENDERFFER (*Pennsylvania Dept. Agr. Rpt. 1897, pt. 1, pp. 649–665, pl. 1*).—This article presents the history, progress, and present condition of tobacco farming in Pennsylvania. The culture of the crop and the importance of the industry are discussed in a popular way.

Wheat culture experiments (*Agr. Jour. Cape of Good Hope, 12 (1898), No. 9, pp. 471–474*).—A report on variety tests of wheat. Early Baart, Eckstein Korn, and Neapolitan were practically free from rust.

Wheat growing (*New Brunswick Agr. Rpt. 1897, pp. 235–238*).—A popular article, encouraging a more extensive and intelligent system of wheat growing and the establishment of a suitable milling industry in New Brunswick. Notes on the culture of wheat are given.

HORTICULTURE.

On the use of commercial fertilizers for forcing-house crops, E. H. JENKINS and W. E. BRITTON (*Connecticut State Sta. Rpt. 1897, pp. 278–309, fig. 1*).—This is a continuation of work reported in previous publications (E. S. R., 8, p. 402; 9, p. 553.)

Tomatoes.—This experiment was made to test still larger quantities of fertilizer chemicals than were used in the previous years, to determine whether the addition of moss peat to the ashes used as a culture medium is advantageous, and to compare the crops grown on rich compost with those grown on ashes and moss peat. The compost used consisted of 2 parts by bulk of turf and 1 part of rotted stable manure.

The ashes were from bituminous coal and were sifted through a screen with 4 meshes to the inch. Two crops of Lorillard tomatoes were grown. The quantities of fertilizers applied per plat, the total yield of fruits, vines, and roots per plat, the average yield of fruit per square foot of bench and per plant, the percentage of perfect-shaped fruits, and the like are given in tables. The growth of the plants and the treatment given them during the tests are briefly noted.

Determinations were made of the nitrogen, phosphoric acid, and potash of the crops of all plats. The results for 4 plats of the second crop are reported. Each plat had an area of 13.87 sq. ft. Two plats were of compost, 1 without the addition of fertilizers, the other fertilized with 17 gm. of nitrogen, 8 gm. of phosphoric acid, and 42 gm. of potash. The other 2 plats were of ashes and peat, 1 fertilized with 65 gm. of nitrogen, 24 gm. phosphoric acid, and 60 gm. potash, the other with 85 gm. nitrogen, 24 gm. of phosphoric acid, and 170 gm. of potash. The fertilizer constituents removed from the soil by the crops on the different plats are shown in the following table:

Nitrogen, phosphoric acid, and potash in tomatoes grown in different culture media.

Fertilizing constituents in the crop.	Coal ashes and moss peat.		Rich compost.	
	Fertilized with 65 gm. nitrogen, 24 gm. phosphoric acid, 60 gm. potash.	Fertilized with 85 gm. nitrogen, 24 gm. phosphoric acid, 170 gm. potash.	Fertilized with 17 gm. nitrogen, 8 gm. phosphoric acid, 42 gm. potash.	Not fertilized.
Nitrogen:	*Grams.*	*Grams.*	*Grams.*	*Grams.*
In roots	0.53	1.22	1.03	1.18
In vines and leaves	10.58	17.16	7.21	5.89
In fruit	11.16	14.77	15.24	10.64
Total nitrogen	22.27	33.15	23.48	17.71
Phosphoric acid:				
In roots	.13	.28	.28	.38
In vines and leaves	2.05	3.05	1.72	1.88
In fruit	4.23	5.16	4.77	3.23
Total phosphoric acid	6.41	8.49	6.77	5.59
Potash:				
In roots	.24	1.04	.88	1.53
In vines and leaves	12.67	35.73	18.52	11.24
In fruit	17.47	28.32	33.03	23.05
Total potash	30.39	65.09	52.43	35.82

The authors give the following summary:

"The yield of tomatoes from benches filled with a rich compost was on the average larger when no fertilizer chemicals were added. The addition of chemicals rather depressed the yield of tomatoes from compost.

"From a mixture of coal ashes and peat with fertilizer chemicals larger crops of tomatoes were produced than from a rich compost of turf and manure in each of the 3 years covered by our experiments.

"Tomatoes are much more productive when grown in a mixture of coal ashes and moss peat than when grown in coal ashes without peat.

"In the tests here reported the plants growing in compost yielded more fruit during the first month than those in ashes and peat. From then on the weekly yield was largest from the plats of ashes and peat.

"The best yields of tomatoes have been from plats of the mixture of coal ashes and moss peat already described, to which had been added per 100 sq. ft. of bench space 6.4 lbs. of nitrate of soda, 1 lb. of dissolved boneblack, and 2.4 lbs. of muriate of potash. The amounts of fertilizer chemicals which can be profitably used depends on the season of the year in which the crop is raised, the watering, and doubtless on other conditions whose effects are not as well understood.

"The crop which is in the house from September to February will not bear as much fertilizer as the following one growing from February to July, because of the smaller amount of sunlight in the first period which the plants can utilize. In the first case the hours of sunlight per day decrease as the foliage increases; in the second case this is reversed.

"Plants which receive large quantities of freely soluble plant food in the soil of ashes and peat have a much less extensive root system than those growing in compost, and when fully grown are likely, in consequence, to wilt more easily."

Carnations.—Experiments were made to determine the fertilizer requirements of carnations grown under glass. Most of the plants were grown in coal ashes and moss peat similar to that used with tomatoes, and some were grown in rich compost. The area of most of the plats was 14.53 sq. ft. The varieties of carnations used were Daybreak, William Scott, Alaska, Garfield, and Lizzie McGowan. The plants continued to blossom from December to July. Notes on the growth of the plants are given and a table shows the fertilizers applied to the various plats, the number and weight of cut flowers per plat, the average number of cut flowers per plant, the average weight and diameter of flowers, and the average length of stem, etc.

Analyses were made of young plants like those set in the various plats, of a number of cut flowers of the different varieties grown on the various plats, and of the entire plants, exclusive of flowers. The calculated amounts of nitrogen, phosphoric acid, and potash in the plants set and in the plants and flowers harvested and the amounts applied to the soil are given in tabular form. The data reported are shown in condensed form in the following table:

Nitrogen, phosphoric acid, and potash in carnations grown with different soils and fertilizers.

Culture media.	Number of plants.	Fertilizer constituents per plat.					
		In plants set and in fertilizers applied.			Removed in the plants.		
		Nitrogen.	Phosphoric acid.	Potash.	Nitrogen.	Phosphoric acid.	Potash.
		Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Coal ashes and moss peat	18	30.47	11.44	51.00	21.54	8.75	42.47
Do	18	35.47	11.44	51.00	26.31	10.67	48.90
Do	18	40.47	11.44	51.00	24.67	9.49	43.81
Do	18	50.47	11.44	51.00	23.12	7.99	39.50
Do	18	35.47	15.44	51.00	23.49	9.21	45.56
Do	18	35.47	11.44	61.00	21.17	8.01	43.49
Do	18	35.47	11.44	76.00	25.53	9.95	54.19
Do	18	48.87	3.44	83.20	26.05	10.63	51.03
Do	18	48.87	18.64	16.00	24.68	9.85	33.70
Do	18	50.47	15.44	61.00	31.88	11.50	56.20
Rich compost	18	10.47	3.44	16.00	21.04	8.83	43.18
Do	18	20.47	7.44	26.00	26.65	11.87	58.31
Coal ashes	15	26.33	9.85	42.00	24.27	8.44	45.34

The abnormality known as "sleepy flowers" is noted, and a test of the effect of nitrogenous fertilizers on the prevalence of such flowers is reported. No very close relationship was found between the amount of nitrogen applied in the fertilizers and the number of "sleepy flowers" produced. The author gives the following summary of the experiments with carnations:

"Carnations have been successfully raised by us in a soil composed of coal ashes and moss peat with commercial fertilizers. The largest yield obtained was an average of 27.3 blooms per plant, or 3,384 blooms per 100 sq. ft. of bench space. The average yield from 7 plats was 25 blooms per plant, or 2,703 per 100 sq. ft. This is an average of Daybreaks and Alaskas, the William Scott variety being excluded from the average. The blooms were of fair size, having an average diameter of 2.1 in.

"The largest crop was gathered from the plat in which 40 gm. of nitrogen, 12 of phosphoric acid, and 60 of potash were mixed with the ashes and peat. This is equivalent to a dressing per 100 sq. ft. of bench space, of 3 lbs. 14 oz. of nitrate of soda, 1 lb. 1 oz. of dissolved boneblack, and 1 lb. 13 oz. of muriate of potash.

"The William Scott variety was badly affected by stem rot and bore many 'sleepy' buds. The Daybreak yielded about 20 per cent more bloom than the Alaska variety, and during December, January, and February yielded twice as many.

"There is no considerable difference in the percentage amount of nitrogen, phosphoric acid, and potash in the fresh-picked blossoms of the 3 varieties tested, the average quantities being, nitrogen, 0.39 per cent, phosphoric acid, 0.15 per cent, potash, 0.68 per cent. Ten thousand Daybreak blooms weigh 191 lbs. and contain 12 oz. nitrogen, 5 oz. phosphoric acid, 1 lb. 5 oz. potash; 10,000 William Scott blooms weigh 187 lbs. and contain 11.7 oz. nitrogen, 4.8 oz. phosphoric acid, 1 lb. 4.6 oz. potash; 10,000 Alaskas blooms weigh 134 lbs. and contain 8.3 oz. nitrogen, 3.4 oz. phosphoric acid, and 14.8 oz. potash.

"A single plat filled with the rich compost . . . did not yield as many blooms as the mixture of ashes and peat."

Radishes.—Cardinal Globe and French Breakfast radishes were grown in ashes and peat and in rich compost, with the addition of various fertilizers. Some of the plats were subirrigated and others surface irrigated. Some of the seed was screened, the small seed being rejected, and some was planted without screening. On part of the plats 3 crops were grown and on part 4 crops. In some cases the fertilizer constituents removed in a crop were added to the soil before the succeeding crop was started, and in some cases no fertilizers were added after the first crop. On part of the plats seed was sown between the rows of half-grown plants in order to hasten the succeeding crop. The fertilizers applied and the yield of radishes are given in tables. The following summary is given:

"By planting between the rows of the half-grown crop 4 crops can be obtained in the time required to raise 3 crops by the usual method of planting.

"There is very little, if any, advantage in subirrigation. In each case save one the weights of the crops were slightly greater from the subirrigated plats, but there was no perceptible difference in the quality of the radishes.

"There was no difference in quality and appearance of the radishes grown in compost and in coal ashes and peat, but those grown in the last-named soil required one or two weeks' less time to reach maturity.

"The crop grown in coal ashes alone was below the average, both in appearance and yield.

"French Breakfast proved inferior to Cardinal Globe as a forcing variety.

"Planting seed selected by sifting out the small seeds (nearly one-third of the whole) made no perceptible difference in either quality or quantity of the crop.

"Very little difference in yield, weight, or time of the maturing of the crop can be ascribed to differences in the quantity of fertilizers used. Good results were obtained by adding to the mixture of coal ashes and peat, for each 100 sq. ft. of bench space, 2.5 lbs. of nitrate of soda, 2.4 lbs. of dissolved boneblack, 1.4 lbs. of muriate of potash. This sufficed for 3 crops of radishes.

"The total yield of radishes (3 crops) from all the plats filled with coal ashes and peat was, for 100 sq. ft. of bench space, 388 bunches (10 in a bunch), or 57 lbs. (tops included).

"The average composition of these radishes was: Water, lost in air drying, 94.35; nitrogen, 0.24; phosphoric acid, 0.062; potash, 0.233.

"According to this year's tests, 1,000 bunches of radishes weigh 147 lbs. and take from the soil 5.6 oz. of nitrogen, 1.4 oz. of phosphoric acid, and 5.4 oz. of potash."

Effects of fertilization on citrus fruits, G. E. COLBY and E. W. HILGARD (*California Sta. Rpt. 1895–1897, pp. 163–181*).—This is a continuation of work previously reported (E. S. R., 8, p. 691). A number of orange trees at the southern California substation have been selected for experiments with fertilizers. Analyses of 1 dozen fruits from each tree before fertilizers were applied are reported for future comparison. In regard to the variations in the composition of the fruits of given varieties the report says:

"In the Washington Navels there is a difference of 1.41 between the highest and lowest sugar percentages, and in the Magnum Bonum it is 2.20 per cent. In fact, in all of the varieties but the Homasassas the difference is above 1 per cent. In acid the variation is proportionally about the same. In amount of juice the differences vary from 1.5 per cent in the Mediterranean Sweet to 9.9 per cent in the Parson Brown. In percentage of rind the greatest difference, 10.6, was observed in the Washington Navel. In weight the differences between the averages of the several trees of the same variety was very small in several cases, while in the Pineapple there was as much as 94 gm."

Analyses of oranges from fertilized trees at North Pomona in 1895 are reprinted from the previous report and compared with analyses of fruit from the same place in 1896. After a discussion of the results obtained the report says:

"In general, then, it may be said that the differences shown in the proximate composition of fertilized and nonfertilized fruits in the Richards grove [North Pomona] are not such as may properly be attributed to fertilization, but fall within the limits of normal variation, as shown by the unfertilized fruit of the station orchard."

In regard to the ash of oranges that have received different fertilizers the following summary is given:

"*Nitrogen.*—The lowest percentages were found to be in those lots either unfertilized or to which no nitrogen fertilizer had been applied. It was lowest of all in that on which potash alone had been used. The results indicate that nitrogen was needed in the soil.

"*Total ash.*—The minimum amount of ash was found in the unfertilized lot; next in that fertilized with potash alone; while the highest percentage of ash was obtained in the fertilization with superphosphates.

"*Phosphoric acid.*—As the tables stand, the minimum amount of phosphoric acid in the ash was found in the fruit fertilized with superphosphate alone and the maximum amount where phosphoric acid and potash were used. But if we make the calculation on an even weight instead of on even numbers of each sample, we obtain very different and at the same time very suggestive results.

"In the unfertilized lot we then find 4.73 lbs. of phosphoric acid in 1,000 lbs. of the fruit; in that fertilized with superphosphate alone it is increased to 5.77 lbs., thus indicating a lack of phosphates in the soil. When nitrogen is supplied in the fertilizer the maximum of 6.27 lbs. is reached, thus again showing, as above noted, the need of nitrogen fertilization.

"*Potash.*—The maximum of potash in the ash was obtained in the lot from the nitrogen fertilizer and the minimum in that of superphosphate; but, calculated per 1,000 lbs. of fruit, we find that the amount of potash in the ash is nearly the same in that unfertilized and in that fertilized with potash alone, thus showing that potash is not deficient in the soil."

In continuation of previous work analyses were made of Washington Navel and St. Michael oranges, grown at West Riverside, to study the effect of potash on the fruit. All the fruits tested were produced on soil which had received fertilizers containing phosphoric acid and nitrogen. Part of the trees were also fertilized with muriate of potash. The Navel oranges which were fertilized with potash had a thinner rind and a lower average percentage of juice, as was the case in the previous year's work. They also showed a lower percentage of sugar in the juice, thus contradicting the former conclusion that potash increased the sugar content. The St. Michael oranges fertilized with potash were smaller, thinner skinned, and more juicy than those not so fertilized. There were practically no differences in sugar and acid content between those fertilized with potash and those not fertilized.

Report of injury to fruit trees during the winter of 1895-96, S. A. BEACH and C. P. CLOSE (*New York State Sta. Rpt. 1896, pp. 408–439*).—An unusual amount of injury to fruit buds and fruit trees was caused by the severe winter of 1895–96. Native plums and sour cherries were practically the only stone fruits which were not seriously injured. To learn the relative hardiness of the different varieties of fruits cultivated in the State, correspondence was carried on with fruit growers in all parts of the State. Replies were received from 442 localities. The State was divided into seven fruit districts, and each district is considered separately in discussing the replies. Notes and tables are given showing the varieties most frequently mentioned, the number of times each was mentioned, and the least, greatest, and average percentages of injury reported for each variety.

Observations on cover crops for orchards, S. A. BEACH and C. P. CLOSE (*New York State Sta. Rpt. 1896, pp. 440–445, pls. 2*).—The advantages of cover crops for orchards are briefly noted and an account is given of various cover crops grown in the station orchards in the fall of 1896. The crops were sown August 1. Sainfoin proved undesirable on account of its slowness in starting and its small growth. Cowpeas made a good growth, but were killed by the first frost.

Crimson clover winterkilled and did not do well on hard clay soil. Canada peas and buckwheat and blue peas and buckwheat gave satisfactory results, both mixtures making a good growth and the peas remaining green until winter. The growth of the Canada peas and buckwheat was so great as to interfere with gathering the winter apples. Winter vetch and winter rye formed a perfect mat of vegetation and remained green over winter. They did not grow high enough to interfere with gathering winter fruit. Mammoth red clover formed a dense covering and remained alive over winter, comparing favorably with winter vetch and winter rye. Dwarf Essex rape made a very rank growth, sufficient to interfere with gathering fruit, and seemed to furnish a hiding place for mice, which girdled several of the trees.

Experiments with fruits, J. L. BUDD (*Iowa Sta. Rpt. 1896–97, pp. 127–130*).—The author reports results of introductions of hardy plums, peaches, cherries, apples, pears, and ornamental plants. The Russian plums introduced in 1883 are of greatest value in the south half of Iowa. Some of the Russian cherries have proved superior to other varieties in hardiness and in size and quality of fruit. The Russian apples are of greatest value in the extreme north. "In Minnesota the whole recommended list at present are Russian varieties or Russian seedlings." One of the greatest benefits of the wide distribution of these apples is the opportunity thus afforded for both natural and artificial crosses with old standard varieties and the production of hardy varieties of good quality. Some of the Russian pears have proved perfectly hardy on high ground in northern Iowa. This is especially true of Gakovsky. In southern Iowa Mongolian Snow has done well. The peaches introduced from Asia have given good results in the southern part of the State. Among ornamental plants, many roses, snowballs, spiræas, honeysuckles, lilacs, etc., have proved hardy as far north as Manitoba and Indian Head.

In regard to hybrid fruits and shrubs the author says:

"Our most promising crosses and hybrids are from prepotent ironclad mothers that come near to reproducing from seed. As examples, we crossed the blossoms of the wild rose of east Europe (*Rosa rugosa*) with pollen of our best garden varieties. The results have been a surprise, as in one generation we have secured double flowers and yet retained mainly the vigor and hardiness of the wild rose. With the gooseberry we crossed the blossoms of the wild species of Manitoba with pollen of the Champion. In this case about all the hybrids bear fruit of the size of the Champion, yet we retain mainly the hardiness of bush of the mother plant.

"With the apple we have used prepotent mothers, such as Hibernal, Duchess, and the Anis, and pollen of our best-known winter varieties. As far as yet fruited the fruit largely follows the variety used for pollen, and leaf and tree mainly follow the mother. In our work of hybridizing the plum we have used our best native varieties for mothers and the pollen of the Japan varieties, mainly for the reason that the European sorts do not seem to cross readily with our native species. With cherries and other fruits we have adhered to the same principle of using prepotent ironclad mothers and pollen from the best known sorts."

Report of the horticulturist, H. L. HUTT (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 91–120, figs. 11*).—A report of the work in

horticulture during the year 1897. A list of the varieties of orchard fruits growing at the college is given. Variety tests of small fruits are reported in tabular form, the tests including 13 varieties of red raspberries, 12 black raspberries, 13 currants, 12 gooseberries, and 150 strawberries. The relative yield of the varieties of strawberries is given for the year 1897 and also for 1896. A marked difference was noted between the relative positions of the varieties in the 2 years. In this connection the author says: "The great change in position of many of these [varieties] shows very clearly how little value should be placed upon the results of but a single test. It is only by the average of a number of trials that we can arrive at a reliable estimate of the value of a variety."

Notes are given on 57 varieties of geraniums used for bedding. The following varieties are recommended by the author as being best for bedding purposes: "Scarlet—General Grant, J. J. Harrison, Alfred Tennyson, Alfred Mame, Prokop Daubec; crimson—S. A. Nutt, Sam. Sloan; magenta crimson—Adrien Corret; pink—Madonna, Mons. de la Rue; salmon—Mrs. E. G. Hill, John Good; white—La Favorite, White Swan; bronze-leaved—Maréchal MacMahon; silver-leaved—Mad. Saleroi; golden leaved—Crystal Palace Gem."

Quantities of mineral matters and nitrogen in violets grown under glass, A. L. WINTON (*Connecticut State Sta. Rpt. 1897, pp. 312, 313*).—An analysis was made of 4 large violet plants, including roots, freed from earth as much as possible, and of 300 flowers as picked for market. The results are shown in the following table:

Percentage composition of violets.

	Plants.	Blooms.
	Per cent.	*Per cent.*
Water	75.845	88.052
Nitrogen	.454	.298
Sand adhering	6.743	.235
Pure ash	2.030	.910
Silica	.235	.031
Oxid of iron	.576	.028
Lime	.182	.075
Magnesia	.075	.070
Potash	.515	.462
Soda	.163	.037
Phosphoric acid	.110	.101
Sulphuric acid	.095	.070
Chlorin	.079	.036

Collection of information on the culture of valuable plants on the Caucasus. III (*Tiflis, 1897, pp. 116; abs. in Selsk. Khoz. i Lyesov., 185 (1897), June, pp. 718, 719*).—This part contains three articles, (1) Tea and the introduction of its culture on the Black Sea coast of the Transcaucasus, by S. N. Timotheyef; (2) The culture of *Pistacia vera* on the Transcaucasus, by E. A. Kamenyetski; (3) *Capparis spinosa* and its exploitation on the Caucasus.—P. FIREMAN.

Distribution of seeds, plants, cuttings, etc., E. J. WICKSON (*California Sta. Rpt. 1895–1897, pp. 302–304*).—A report on the seeds, plants, cuttings, etc., distributed by the station (E. S. R., 9, p. 944).

Fruits of the Foothill Culture Substation, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 307–324*).—Notes and tabular data are given on varieties of almonds, apricots, plums and prunes, and quinces. Notes are also given on figs, peaches, cherries, olives, walnuts, persimmons, and various small fruits.

Horticulture at the Southern Coast Range Culture Substation, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 331–336*).—Notes are given on various fruits, garden shrubs, timber and shade trees, etc. A table is given showing the growth of a number of fruits on hardpan. Smudging orchards to prevent injury from frost was not successful against long-continued and severe frosts.

Report of the horticultural department, J. TROOP (*Indiana Sta. Rpt. 1897, pp. 35–40, fig. 1*).—An outline of the work of the year is given. A variety test of some 20 varieties of potatoes is reported.

Outline of the work of the horticultural department, S. A. BEACH (*New York State Sta. Rpt. 1896, pp. 265, 266*).

Melons, squashes, and vegetables at the Southern Coast Range Substation, A. V. STUBENRAUCH (*California Sta. Rpt. 1895–1897, pp. 343–345*).—Brief notes on muskmelons, watermelons, squashes, pumpkins, cucumbers, tomatoes, eggplants, okra, peppers, lentils, and the like.

Garden vegetables and various trees, E. J. WICKSON (*California Sta. Rpt. 1895–1897, pp. 292–297*).—Reports from correspondents on perennial beans, Ceylon pea, New Zealand spinach (*Tetragonia expansa*), paper mulberry (*Broussonetia papyrifera*), and guavas distributed by the station. The perennial beans are large white beans. Some of them show a tendency to produce two crops a year, and their roots survive ordinary winters in California. The Ceylon pea has large pods, is very prolific, grows well throughout the State, and is of value as a late pea for table or for canning. The New Zealand spinach stands drought well and is useful as a table vegetable and for binding light soils. The paper mulberry is of value as an ornamental plant. In moist ground it suckers abundantly from the roots. Five varieties of guavas from Lucknow, India, sent out for comparison with varieties growing in the State have been found too tender for the climate.

Testing fruits, S. A. BEACH, W. PADDOCK, and C. P. CLOSE (*New York State Sta. Rpt. 1896, pp. 267–300, pls. 5*).—This is a continuation of work reported in the report of the station for 1895. The purpose of variety tests is noted and a table is given showing the number of varieties of each of the various orchard and small fruits now under test at the station, the total number being 3,088. Notes are given on 22 varieties of apples and 5 varieties of grapes, the fruit of 5 of the apples being illustrated. A table shows the yield in 1896, age of trees or grafts, and season of ripening of 261 varieties of apples and 21 varieties of crab apples. A list of 155 varieties of pears, 9 quinces, 20 apricots, 58 cherries, 120 peaches, 197 plums, 240 grapes, and 49 currants growing at the station is given. The yield of 9 varieties of black currants and 18 varieties of red and white currants is given in tabular form.

Almonds, peaches, and nectarines at the Southern California Substation, C. H. SHINN and J. W. MILLS (*California Sta. Rpt. 1895–1897, pp. 391–405*).—This consists of notes on the behavior of varieties of almonds, peaches, and nectarines for a number of years.

Thinning fruit, S. A. BEACH (*New York State Sta. Rpt. 1896, pp. 378–383*).—This article is practically the same as one read before the Hudson Valley [New York] Horticultural Society (E. S. R., 9, p. 448).

Orchard fruits and date palms at the San Joaquin Valley Culture Substation, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 353–362*).—Notes and tabular data are given on a considerable number of varieties of apples, pears, almonds, peaches, nectarines, cherries, plums and prunes, and date palms.

Orchard and small fruits, trees, shrubs, and other plants at the Southern California Substation, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 368–383, pls. 3*).—Brief notes, accompanied in some cases with tabular data, regarding the behavior of varieties.

Analyses of oranges, lemons, and pomelos, G. E. COLBY (*California Sta. Rpt. 1895–1897, pp. 161, 162*).—Analyses of fruits received from December, 1895, to April, 1897, are reported.

Proximate analyses of prunes, plums, dried fruits, and raisins, G. E. COLBY (*California Sta. Rpt. 1895–1897, pp. 183–185*).—Analyses of various fruits sent to the station for examination.

The causes of "frogging" and "bloating" of prunes, F. T. BIOLETTI (*California Sta. Rpt. 1895–1897, pp. 254–261, pls. 4*).—A reprint of Bulletin 114 of the station (E. S. R., 8, p. 979), with the addition of three plates.

Olives and olive oil, A. P. HAYNE (*California Sta. Rpt. 1895–1897, pp. 191–193*).—A note on the olive industry, with suggestions for its improvement.

Analyses of California olives, G. E. COLBY (*California Sta. Rpt. 1895–1897, pp. 193–207*).—This is a continuation of work recorded in the Annual Report of the station for 1894–95 (E. S. R., 8, p. 701). The data in the previous report are republished, together with analyses for the year 1896. In addition to the record of analyses of the individual samples, the maximum, minimum, and average composition for each variety of olive studied are given.

New apparatus for crushing olives (*California Sta. Rpt. 1895–1897, pp. 208, 209, fig. 1*).—A description of a machine for crushing olives preparatory to the extraction of the oil is published as furnished by the makers.

Examination of sulphured (bleached) fruit (*California Sta. Rpt. 1895–1897, p. 186*).—Sulphured prunes were found to contain 0.33 per cent and raisins 0.36 per cent of sulphuric acid.

Blackberries, dewberries, and raspberries, W. PADDOCK (*New York State Sta. Rpt. 1896, pp. 344–358*).—A reprint of Bulletin 111 of the station (E. S. R., 9, p. 137).

Gooseberries, S. A. BEACH (*New York State Sta. Rpt. 1896, pp. 300–344, pls. 15*).—A reprint of Bulletin 114 of the station (E. S. R., 9, p. 138).

Strawberries, W. PADDOCK (*New York State Sta. Rpt. 1896, pp. 358–377, pl. 1*).—A reprint of Bulletin 109 of the station (E. S. R., 8, p. 786).

The economic position of Russian grape culture and wine making, N. N. KOSHKIN (*Rpt. Min. Agr. and Govt. Estates, Div. Rural Econ. and Agr. Stat. St. Petersburg, 1897, pp. 91; abs. in Selsk. Khoz. i Lyesov., 186 (1897), Sept., p. 713*).

Culture of grapes and the contest against phylloxera, P. STROYEV (*Selsk. Khoz. i Lyesov., 186 (1897), Aug., pp. 431–452*).—The author recommends the Russian horticulturists to employ the capital which they spend in combating the phylloxera in Bessarabia in introducing American vines which are not affected by the phylloxera.—P. FIREMAN.

Memoranda on wine, table, and raisin grapes, F. T. BIOLETTI (*California Sta. Rpt. 1895–1897, pp. 245–253*).—This is a summary of the results obtained with various varieties of grapes at the several substations of the State, the details of which have been reported in previous viticultural reports.

California walnuts, almonds, and chestnuts, G. E. COLBY (*California Sta. Rpt. 1895–1897, pp. 142–159*).—A reprint from Bulletin 113 of the station (E. S. R., 8, p. 786) rearranged and with somewhat more extensive notes and the addition of a table comparing the composition of fresh almond hulls with that of green alfalfa.

The bleaching of nuts by dipping, E. W. HILGARD (*California Sta. Rpt. 1895–1897, pp. 159, 160*).—Reprinted from Bulletin 113 of the station (E. S. R., 8, p. 788).

FORESTRY.

A report of forestry substations, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 406–426, pl. 1*).—The author gives a report of the present condition of the forest substations at Chico and Santa Monica. Brief notes are given on the general culture pursued at the Chico station and comparisons made with the two pine plantations of *Pinus resinosa* and

P. sylvestris. Both blocks were set in 1889–90. The *P. resinosa* trees average 17 ft. in height and the Scotch pine about 13 ft.

Observations were made by an inspector of the young trees in the Sierra showing that seedling pines and other conifers wherever protected from sheep and cattle form close thickets in a few years. During the winter of 1895–96, which was a very severe one, quite a number of Eucalyptus and Acacia trees were destroyed, as well as a number of carob trees. The heat of the following summer destroyed quite a number of trees, among which were specimens of Abies, Sassafras, and *Cephalotaxus drupacea.* The Japanese oaks have also proved unadapted to this region. The rate of growth of trees in the forest is shown in a table compiled from records made by the foreman of the station. The growth of 9 specimens of conifers and 4 deciduous trees are tabulated as follows:

Statistics of tree growth, 1894 to 1896, inclusive.

Name.	Growth, 1894.		Growth, 1895.		Growth, 1896.	
	Height.	Circumference.	Height.	Circumference.	Height.	Circumference.
	Feet.	*Inches.*	*Feet.*	*Inches.*	*Feet.*	*Inches.*
Chamæcyparis lawsoniana	8	12	10	12	13	15
Catalpa speciosa	16	16	21	21	26	25
Negundo californica	15	11	18	12	24	18
Pinus austriaca	5	6	9	10	14	14
P. insignis	11	9	13	11	19	19
P. resinosa	7	7	11	9	17	13
P. sylvestris	7	9	9	10	13	11
Pseudotsuga taxifolia	3½	Not taken.	5	4	9½	7
Sequoia gigantea	13	16	17	25	21	31
S. sempervirens	6	Not taken.	13	10	17	13
Cupressus sempervirens	15	8	20	12	22	16½
Paulownia imperialis	19	19	21	23	24	30
Juglans californica	12½	14	18	20	23	25

A list of trees and number of species being tested at the station is given. The general condition of the Santa Monica station is described and temperature and rainfall records for the years 1893–1897 are included, together with descriptive notes and improvements.

Measurements have been made of the larger Eucalyptus trees in the main grove and the results were tabulated, showing the growth of the trees for the years 1894, 1895, and 1896. The trees were mostly planted in 1889 and 1890, and in many cases have attained very considerable size. One specimen of *Eucalyptus globulus* was measured in 1896, being reported as 46 ft. high and 19 in. in diameter, with a spread of top of 28 ft.

The flowering time of the various species of Eucalyptus are given, the lengths of their blooming period, and their possible use as bee pasturage. A table is given in which the comparative resistance of several of the more common species of Eucalyptus is shown. The figures given seem to indicate that *Eucalyptus globulus* and *E. corynocalyx* are among the most resistant. Brief descriptive notes are given of some recent additions to the arboretum, among which are some Japanese bamboos, *Morus multicaulis*, various willows, etc.

Forestry plantations, J. L. BUDD (*Iowa Sta. Rpt. 1896–97, pp. 126, 127*).—The author reports upon the present condition of forestry plantations, the trees of which were planted from 15 to 21 years ago on both high and low lands. The land selected was 4 knolls of thin soil, with parts of the valley between dry enough for plowing. The trees were planted 4 ft. apart each way and cultivated until the tops shaded the ground fairly well. On knoll 1 the box elders and catalpas have, as a rule, made scrubby, dwarfed growth. Specimens of black oak 1 ft. above the ground are 43 in. in circumference, Riga pine 43, basswood 39, Austrian pine 36, red cedar 23, catalpa 21. In the case of the catalpa tree the trees measured were exceptional; in the other cases average trees were taken. Upon the low ground at the base of this plat box elder, catalpa, basswood, and hard maple made a large, even growth.

The second portion of the plantation was devoted largely to white pine and European larch, alternated with box elder and green ash. On the hilly ground the white pine has grown very successfully, many of the trees being 44 in. in circumference and 50 ft. in height. The best larches measure 31 in. in circumference and are as high as the pines. The box elder and ash, as a rule, have been crowded out except in the lower grounds. The white pine and larch on the low land are equal in size and stand to those on the hill.

The third part of the plantation was planted mostly with black walnut and butternut, with some box elder, white elm, green ash, and black wild cherry. In the bottom lands the black walnuts average 50 ft. in height, with stems 29 in. in circumference. The only trees not crowded out by their growth is the white elm, which in height and vigor of growth is about equal to the black walnut. On the hilly part of the plantation the only thrifty trees are the European larch and the black wild cherry. At the time of the planting the belief was common that the butternut was a high-land tree, and no specimens were planted in the low lands. On the hills most of the trees are either dead or their tops are dying.

In the fourth part of the plantation green ash was planted exclusively, and with 20 years' growth the largest trees on the low land are 25 in. in circumference. Upon the high ground the trees stand much better than where alternated with black walnut, white pine, and larch, but they are of small size, showing that they should have been thinned at least 10 years ago.

Of the conifers planted on the college campus during the past 20 years the species that have remained thrifty in isolated positions in blue-grass sod are white, Black Hills, silver, and Douglas spruce; Douglas and concolor fir; and white, Black Hills, dwarf mountain, red, riga, and some specimens of Austrian pines. Black and Norway spruce, Scotch pine, common fir, and American and European larch do not withstand drought in isolated positions as well as in timber plantations.

Timber and shade trees, C. H. SHINN (*California Sta. Rpt. 1895–1897, pp. 336–338*).—The author in a brief report gives a limited list of shade, ornamental, and timber trees which 8 years of experience has shown to be well adapted to the lands east of the Salinas. The important factors to be considered in determining the hardiness are ability to resist drought, thrive on poor soils, and capacity to penetrate hard-pan of various depths and various degrees of solidity.

Among the trees best adapted to these conditions are some of the oaks, particularly *Quercus pedunculata*, *Q. douglasi*, and *Q. lobata*. Of these the English oak, *Q. pedunculata*, was by far the best. Among other deciduous trees of merit in this respect are mulberries, box elders, and black locusts. Notes are also given on the mulberry tree, several species of pine, casuarina, 3 species of fir, *Cedrus deodar*, *Eucalyptus globulus*, *Paulownia imperialis*, and Osage orange.

Brief review of the activity of the forestry department during the two years from June, 1895, to June, 1897 (*Selsk. Khoz. i Lyesov., 186 (1897), Aug., pp. 241–314*).

The influence of local conditions on tree growth, W. GILL (*Jour. Agr. and Ind. South Australia, 1 (1898), No. 9, pp. 675–677*).

SEEDS—WEEDS.

Tests of the vitality of vegetable seeds, E. H. JENKINS (*Connecticut State Sta. Rpt. 1897, pp. 383–391*).—The author reports on tests of a number of vegetable seeds. The tests were conducted in accordance with the rules adopted by the Association of American Agricultural Colleges and Experiment Stations, as published in Circular 34 of this Office (E. S. R., 9, p. 143). Six hundred and fifty-five samples of seeds were tested for their vitality, and it was found that on an average the samples of beet, cabbage, and carrot seed which were over one year old had a higher germinative capacity than new seed. This fact was probably due to the generally better quality of the previous years' seed. The author states that the results of several years' tests would probably show that, taking one year with another, new seed would sprout better than seed one or more years old.

A series of tests was made of the vitality of onion seed, 131 samples of seed from the crops of 1896 and 1897 raised in Connecticut, Rhode Island, and California being compared. As a rule the vitality of seed decreases with age, but there were some cases in which 2-year-old seed sprouted better than that of the new crop. The vitality of the California-grown seed was considerably higher than that of the Connecticut. Forty-four samples of Connecticut-grown seed of the crop of 1896 were tested and gave an average of 72.4 per cent germination. Thirty-nine samples of seed from the crop of 1897 gave an average of 77.9 per cent. The crop of 1895 gave, as an average of tests, a germinative capacity of 85.5 per cent. The average weight of onion seed and the germinative ability of different varieties are given. The author

has tabulated the results of his experiments, showing the usual data of such experiments.

Seed testing: Its importance, history, and some results, C. R. BALL (*Iowa Sta. Rpt. 1896–97, pp. 161–175*).—The author gives a brief review of the importance of seed testing, together with an historical sketch of seed control in Europe and this country. He reports at some length seed tests made at the station in 1897. The seeds were bought in February from five different seedsmen, and were supposedly of the crop of 1896. Twenty varieties of seeds were purchased and tested in the spring of the year and again in the fall, the seed being taken from the same packages in each case. The vitality tests showed, for the most part, that the seed were fairly good but considerably below the recognized standard. Most of the tests showed a declining vitality, but in the case of the cucurbit seeds in nearly every instance the autumn tests gave a higher percentage of germination than those obtained in the spring.

Reports of the Danish Markfrökontor (seed house) for 1896 and 1897 (*Copenhagen, 1897, pp. 32; 1898, pp. 40*).—The twenty-fourth and twenty-fifth annual reports of "Markfrökontoret," containing many papers on seeds and farm crops.

Report of the seed-control station in Lund (Sweden) for 1897, B. JÖNSSON (*Malmö, 1898, pp. 29*).

Influence of dividing mother beets on seed production, F. LUBANSKI (*Bl. Zuckerrubenbau., 5 (1898), Nos. 6, pp. 86, 87; 7, pp. 97, 98*).

On the methods of testing and estimating the value of beet seed, R. HARTLEB and A. GILLMEISTER (*Jour. Landw., 46 (1898), No. 2, pp. 185–206*).

The germinative power of grain immersed in water, H. COUPIN (*Jour. Agr. Prat., 62 (1898), No. 21, p. 752*).—Results of experiments with various kinds of seeds are reported. When immersed in running water for 48 hours 70 per cent of buckwheat, 100 of wheat, 89 of maize, and 96 of peas germinated. When immersed for the same time in standing water the percentage of germination was 52, 97, 80, and 85, respectively.

Concerning the artificial drying of seed of cereals with reference to their germination, F. NOBBE (*Mitt. Deut. Landw. Gesell., 12 (1897), No. 14, pp. 185, 186*).

American clover seed in Austria-Hungary, C. B. HURST (*U. S. Consular Rpts., 1898, No. 212, pp. 120–122*).—A brief account is given of the attempt being made to exclude American clover seed from Austria-Hungary. The basis of the exclusion is the danger from the presence of dodder seed (*Cuscuta epithymum*).

Analyses of seeds, A. K. SABANINE (*Contrib. Agr. Lab. Univ. Moscow, 1896, pp. 47; abs. in Selsk. Khoz. i Lyesov., 185 (1897), Apr., p. 242*).—Of the various conclusions drawn by the author from his analyses of the seeds of different field plants grown in Russia the most interesting is that the nitrogen content of grains of rye increases as the place of growth proceeds from west to east or as the climate becomes more and more continental—a phenomenon already observed by other investigators in regard to wheat, barley, and millet. The author also noticed that the greater the amount of nitrogen in the rye grains the smaller the amount of ash.—P. FIREMAN.

Seed breeding, W. W. TRACY (*Amer. Florist, 13 (1898), No. 520, pp. 1251, 1252*).

Note on the distribution of Pseudocommis vitis by the winds, M. BÉLÈZE (*Bul. Soc. Mycol. France, 14 (1898), No. 1, p. 27*).

Investigations on the development of the seed of Utricularia, M. MERZ (*Flora, 84 (1897), Sup., pp. 69–87; abs. in Bot. Centbl., 74 (1898), No. 4–5, pp. 133, 134*).

Clover dodder, H. KRAUT (*Deut. Landw. Presse, 25 (1898) No. 26, p. 287*).

DISEASES OF PLANTS.

Report of the mycologist, F. C. STEWART (*New York State Sta. Rpt. 1896, pp. 447–521, pls. 4*).—The author gives a review of the year's work, the most of which has been published in bulletin form.

Notes are given on several miscellaneous plant diseases that have been noticed by the author. A disease of turnip leaves which was due to *Macrosporium herculeum* is figured and described at some length. The fungus produces circular, brittle, dead spots on the leaves and when the spots are numerous the leaves wither and fall off. While many of the species of Macrosporium are saprophytic, this species, the author states, is undoubtedly a parasite. A similar disease is reported on the foliage of horse-radish during the summer. However, it is not thought that either on the turnip or horse-radish will sufficient injury be done to warrant the expense of spraying.

A blight of corn leaves, the primary cause of which is attributed to the parasitic fungus *Helminthosporium inconspicuum*, has caused considerable injury in some localities. The diseased leaves have somewhat the appearance of having been frosted. If the surface of the leaves beneath the diseased spots be examined it will be found covered with a delicate, olive-green mold. This disease is said to attack both sweet and field corn. There is a disease of sweet corn due to bacteria which might be mistaken for this disease. The latter disease makes its appearance early in the season, while *Helminthosporium inconspicuum* usually does not appear until August. No practical remedy is suggested. The bacterial disease has been fully described in Bulletin 130 of the station (E. S. R., 9, p. 1056).

The author describes an injury of the foliage of Norway maples which is attributed to the action of dry winds, the entire foliage of some trees being scorched as if by fire or as though killed by a heavy frost. For a period of about a week previous to the appearance of the injury the temperature had been unusually high and during the last three days strong dry winds had blown steadily from the West. The explanation of the injury is that it is due to a disturbance in the transpiration of the trees. In addition to the Norway maple, white pine, pear, and apple trees were slightly injured by the same cause.

Brief notes are given on a leaf-spot disease of linden due to *Cercospora microsora*, a leaf spot of apples due to *Phyllosticta limitata*, two diseases of sunflowers caused by *Septoria helianthi* and *Puccinia helianthi*, a disease of the horse-chestnut caused by *Phyllosticta sphæropsoidea*, a sycamore disease caused by *Glœosporium nervisequum*, asparagus rust, and a clover rust which are described in more or less detail, all of them having proved injurious during the year. The author also reports the occurrence or additional localities for *Exoascus cerasi*, *Exobasidium peckii*, and *Ramularia cylindriopsis*.

Reports are made on the work in combating carnation rust, which was published as Bulletin 100 of the station (E. S. R., 8, p. 238), potato

diseases on Long Island in the season of 1895, which appeared originally as Bulletin 101 (E. S. R., 8, p. 234), and the cucumber flea-beetle as the cause of "pimply" potatoes, which has previously been published as Bulletin 113 of the station (E. S. R., 9, p. 156).

The mildew of Lima beans, W. C. STURGIS (*Connecticut State Sta. Rpt. 1897, pp. 159–166, figs. 4*).—Investigations are reported in which the author sought to find the manner in which the bean pods are infected by the mildew of Lima beans (*Phytophthora phaseoli*). It was thought probable that preliminary information as to the means by which the disease is spread might result in securing means for its prevention.

Studies of the flower show that bees are the source of dissemination of the fungus spores and that the first attack of the fungus is at two points, namely, the style and the base of the ovary, where the bee, searching for nectar, touches the more moist and delicate tissues of the flower. In most cases where young diseased pods were examined it was found that the infection first appeared at the base or tip—very rarely in the middle.

The author also shows that wind plays an important part in the dissemination of this mildew. An experiment was conducted in which mildewed pods were brought from a distance and the spores allowed to infect the surface of sound, nearly ripe pods at one end of a row of pole Limas. Within a few days the mildew made its appearance on these infected pods, and within two weeks (the prevailing winds having been in that direction) the disease had spread from one end of the row to the other.

While from the nature of the disease it would seem probable that the use of fungicides would present many difficulties, yet from experiments in which Bordeaux mixture, ammoniacal copper carbonate solution, sulphur, and potassium sulphid were used it appeared that when three applications of Bordeaux mixture was followed by two applications of ammoniacal copper carbonate solution the amount of the disease was greatly reduced.

The conclusions drawn from the experiments with fungicides show that even in a season most favorable for the Lima bean mildew a thorough treatment of the vines with Bordeaux mixture will insure a crop. The selection of well-drained land and a light soil, reducing the number of vines in the hill, and planting the poles erect will insure conditions as little favorable to the development of the fungus as possible.

On the cause and prevention of a fungus disease of the apple, W. C. STURGIS (*Connecticut State Sta. Rpt. 1897, pp. 171–175*).—During the autumn of 1896 a rather peculiar disease of Rhode Island Greenings and Newtown Pippins was observed. It was characterized by blotches, circular in outline, pale at first and later becoming sooty black and exhibiting under a lens a radiating structure. The individual blotches measured from a quarter to a half inch in diameter, in many cases coalescing and covering the surface of the apple with a sooty coating.

The fungus growth seems to attack the fruit late in the season and to be strictly superficial, but aside from the unsightly condition of the fruits apparently producing no serious injury. The author is inclined to believe that the disease is due to the fungus which has been determined as *Dothidea pomigena*, but a spot disease of Baldwin apples from the Vermont Station which differed widely in appearance has been determined as due to the fungus named. In the author's opinion the Vermont fungus is entirely different.

Experiments with Bordeaux mixture show that if this fungicide is applied at intervals of two weeks from the middle of June to the middle of August it will entirely prevent the appearance of the sooty fungus.

Although apparently occurring principally on Rhode Island Greenings and a few other varieties, it is probable that the fungus will, under favorable conditions, attack most varieties of apples and pears, but all observers agree in stating that it may be controlled by the use of Bordeaux mixture.

Preliminary investigations on a disease of carnations, W. C. STURGIS (*Connecticut State Sta. Rpt. 1897, pp. 175–181*).—The variety of carnation known as William Scott grown in the station greenhouse was observed as exhibiting a marked diseased condition. The disease appeared first as a yellowing of the lower leaves, which later became dry and dead. As the disease progressed, the whole plant became involved and was ultimately destroyed. The disease, which is properly known as "die back" or "stem rot," has been determined as due to a species of Fusarium which gains access to the tissues at or just below the surface of the soil. The mycelium accumulates in the water ducts of the stem, thus preventing the free transfer of water. The author discusses the relationships of this form with other species and thinks probably it is identical with *Fusarium niveum*, described by E. F. Smith[1] as the wilt fungus of watermelon and allied plants.

There is a strong probability that the disease may be communicated by cuttings and that the spores of the fungus are capable of retaining their vitality for several months, living over winter in the earth. Where practicable, as in greenhouses, etc., sterilizing the soil by means of steam or hot air would be effective in preventing attacks of the fungus. In sterilized soil the only possible source of contamination would be through the introduction of diseased cuttings. Certain varieties are more susceptible to the disease than others, the variety William Scott being one of those most subject to the attack. The immediate removal and destruction of all plants showing diseased symptoms are recommended.

Some diseases of olives, F. T. BIOLETTI (*California Sta. Rpt. 1895–1897, pp. 234–236, pl. 1*).—The author briefly describes some of the more troublesome diseases of olives that have recently come to his observation. In one of these the olives, from their outside appearance, seem to be perfectly healthy, but on being cut open show black spots and little

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[1] Amer. Assoc. Adv Sci., 43 (1894), p 289.

cavities near the pit. Where the disease has progressed further sunken areas appear on the outside, while inside the fruit the black spots are larger, often extending all around the pit. As the disease progresses the fruit gradually shrinks and dries up, the skin remaining unbroken. Microscopic examination of these parts showed the presence of large numbers of motile bacteria. Pure cultures were made of the bacterium and its characteristics were partly determined, as follows:

"It grew slowly in beef broth and rapidly in a decoction of vine wood. On peptone meat gelatin its growth was small and slow. On the vine-wood decoction, solidified with 12 per cent of gelatin, it grew rapidly. In puncture cultures it made a tack-shaped growth, white, granular, and raised top; in streak cultures it made a granular growth, consisting of small, round, white colonies. On potato it made a light, yellowish growth and darkened the potato. It was motile, aerobic, and did not color nor liquefy the gelatin. In form it was a small bacillus with rounded ends, 1 to 1.7μ by 0.7μ, generally single or in pairs."

Inoculations with pure cultures gave negative results. The disease does not seem to affect the fruit nor to injure it appreciably until it commences to soften. It does not affect the oil-making varieties and is probably not dangerous. The fruit on affected trees should be picked early and used for pickling.

Another troublesome disease of the olive is figured and described. This disease begins at the apex and works toward the stem end of the fruit. When the olives are cut one-sixth to one-third seems to be brown and partially dried up. Numerous cultures made of the mycelial threads taken from the interior of the diseased olives developed two fungi, one a Macrosporium, the other an Alternaria. Both fungi are figured and described at some length. The author suggests that spraying the trees with Bordeaux mixture would probably prevent the spread of the disease. As it seems so far to be confined to the variety known as Nevadillo blanco, this variety should be omitted in planting where the disease is found to be prevalent.

Alfalfa leaf spot, R. COMBS (*Iowa Sta. Rpt. 1896–97, pp. 155–160, figs. 4*).—The author gives an illustrated description of alfalfa leaf spot, caused by *Pseudopeziza medicaginis*, and reports a number of experiments made to determine the method of infection and also the parts of the plant subject to attack. His experiments show that the spores of the fungus may be carried by the air and that the disease is strictly local in its attack, the mycelium being confined to a limited space on the leaf. The author recommends the burning of all refuse in the field, since the disease readily survives the winter. Frequent cutting of the crop is also effective in holding the disease in check. It is thought advisable, where seed is obtained from suspected or known infested regions, that it should be soaked in a 10 per cent solution of copper sulphate before sowing.

Report of the botanical department, J. C. ARTHUR (*Indiana Sta. Rpt. 1897, pp. 25–34*).—The author gives a brief résumé of various lines of investigation carried on during the year. The experiments

which were begun in the greenhouse in the winter of 1895–96 with formalin for the prevention of potato scab have been continued in the field, and Bulletin 65 of the station issued on the subject (E. S. R., 9, p. 456). Notes are given from correspondence with different individuals relative to the use of formalin as a preventive of potato scab, from which it appears that if this fungicide is properly applied and the seed potatoes planted in uninfested soil a clean crop of potatoes will be secured. Studies have been made on the growing of lettuce in the greenhouse, and the most important conclusions have been embodied in Bulletin 66 of the station (E. S. R., 9, p. 1047). Observations and studies on corn smut have been continued.

Continued observations have been made on a peculiar sugar-destroying disease of the sugar beet, which was previously reported in Bulletin 39 of the station (E. S. R., 3, p. 853). The bacterial nature of the disease has been confirmed and a future publication is promised of the results of the investigation.

Investigations have been continued in the growing of roses and cineraria, and some notes are given of studies on the proper food of plants.

Experiments have been continued on the effect of size of seed on production, peas and beans being used. The author has attempted to ascertain the law of increase in size when brought about solely by selection of the largest seed through a series of generations.

Subwatering for greenhouses and outside storage has been under consideration.

Report of the bacteriologist, F. C. HARRISON (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 121–128, figs. 2*).—A report is given of the routine work in connection with the agricultural college and of an experiment conducted to ascertain the effect of spraying Bordeaux mixture on foliage. Eight seedling pears and two each of peach and quince were sprayed with Bordeaux mixture containing different amounts of lime. The plants were potted and kept in greenhouses, so that uniform conditions could be maintained. Four applications of the fungicide were made and specimens of the leaves examined. Later three more sprayings were given. The most noticeable feature, as shown by microscopic examinations of the leaves, was the increase in number of chlorophyll granules both in the palisade cells and in the spongy parenchyma of the sprayed leaves. In many cases the treated leaves showed the presence of a third layer of palisade cells more or less continuous. Measurements of the thickness of the leaves were made by means of a micrometer, and in every case but one there was an increased thickness, due to spraying. When an excess of lime was used the leaves were thicker than when a smaller quantity was used. The addition of lime seemed to give the foliage increased vigor. The author thinks that it would be advisable to use larger amounts of lime in the preparation of Bordeaux mixture. The increased thickness of the leaves seems to be due to an increased development of the palisade layer of cells.

On the prevention of leaf blight and leaf spot of celery, W. C. STURGIS (*Connecticut State Sta. Rpt. 1897, pp. 167–171*).—Notes are given on leaf blight and leaf spot of celery caused by *Cercospora apii* and *Septoria petroselini apii*. In the Annual Report of the station for 1892 (E. S. R., 4, p. 929) the beneficial effect of sulphur for the prevention of this disease was pointed out, but the investigations of the Rhode Island Station[1] and recent investigations by the author indicate that methods of cultivation exert a very considerable influence on the disease, the level culture seeming to make the plants more liable to infection than the old method of trench culture. The author agrees with the conclusions of the Rhode Island Station, and states that the objections to the level culture may be at least partially removed by mulching heavily between the rows of celery.

Experiments are reported with fungicides in which Bordeaux mixture, potassium sulphid, ammoniacal solution of copper carbonate, and sulphur were tested for the prevention of these diseases. It appeared that sulphur applied as a dry powder was superior to any of the other fungicides. Its effect in checking the spread of the blight in the storage house has not been determined.

Plum leaf spot, S. A. BEACH (*New York State Sta. Rpt. 1896, pp. 384–401, pls. 5*).—The experiments here reported are in continuation of those given in Bulletin 98 of the station (E. S. R., 8, p. 139), attempts being made to control the plum leaf spot by spraying with fungicides. As a result of this year's investigations the author recommends spraying trees three times with Bordeaux mixture, the first application being made about May 25, or about 10 days after the blossoms have fallen, the second about 3 weeks later, and the third about 4 weeks after the second.

Prevention of fungus diseases in cherry orchards, S. A. BEACH (*New York State Sta. Rpt. 1896, pp. 402–407, pl. 1*).—A report is given of experiments conducted for the prevention of leaf spot and the fruit rot of cherries, which are in continuation of those reported in Bulletin 98 of the station (E. S. R., 8, p. 139). In these experiments eau celeste soap mixture was compared with Bordeaux mixture. In 1895, while the diseases were prevented to some extent by the use of fungicides, the foliage was seriously injured, the eau celeste being most injurious. In the experiments in 1896 no injury resulted to the foliage sprayed with Bordeaux mixture, even when the trees were thoroughly drenched with the solution. The results of the two years' work did not give conclusive evidence as to the best lines of treatment of leaf spot on cherry trees, consequently no definite treatment is recommended.

A steam sterilizer for soils, W. E. BRITTON (*Connecticut State Sta. Rpt. 1897, pp. 310–312, pl. 1*).—The author figures and describes an apparatus designed for the sterilization of soil by steam, the object being to rid the soil of fungi, fungus spores, nematodes, etc. It was

[1] Rhode Island Sta. Bul. 44 (E. S. R., 9, p. 146).

found that in soil kept in the apparatus for one hour the nematodes were destroyed, as well as many fungus germs. In order to secure absolute sterility from bacteria and other fungi a much longer exposure would be required. The steamed soil was also almost wholly free from live weed seeds, while untreated soil was considerably affected by them.

Blight and other plant diseases, C. S. CRANDALL (*Colorado Sta. Bul. 41, pp. 21*).—The author has given compiled notes on the cause and means of prevention of the fire blight of the pear and apple. Notes are also given on mechanical injuries to which fruit trees are subject, as well as some of the more common fungus diseases, such as leaf blight or rust of strawberries and orange rust, and anthracnose of blackberries and raspberries.

Injurious fungi, J. H. PANTON (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, p. 23*).—Brief notes are given on some of the more injurious fungi which affect garden and orchard products. The use of Bordeaux mixture is recommended for their prevention.

The most important diseases of our cultivated plants caused by parasitic fungi. I. The diseases of cereal grasses, V. K. VARLIKH (*St. Petersburg, 1897, pp. IV + 37, figs. 19; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Nov., p. 449*).

Album of aquarelle drawings of A. N. Myasoyedov of the most injurious parasitic fungi of trees and of the injuries to the wood of the principal Russian forest trees, I. P. BORODIN, editor (*St. Petersburg, 1896, 10 tables in folio with explanatory text; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Nov., p. 441*).

Brief sketch of mycology, with notes on the fungi most injurious to agriculture and forestry, I. P. BORODIN (*St. Petersburg, 1897, pp. 4 + 231 + VII, figs. 232; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Nov., p. 440*).

On certain diseases of fungal and algal origin affecting economic plants in India, D. D. CUNNINGHAM (*Sci. Mem. Med. Officers of Army of India, 1897, pt. 10, pp. 95–130*).

On the sudden destruction of sugar cane in East Java by the "Dongkellan" disease, KOBUS (*Arch. Java Suikerind., 5 (1897), pp 821–826; abs. in Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 8, p. 348*).—This disease is usually attributed to *Marasmius sacchari*.

Investigations on some sugar-cane diseases (*Meded. Proefstat. Suikerriet W. Java, 1897, No. 30, pp. 5; abs. in Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 8, p. 347*).

Investigations of Phytophthora infestans, a cause of potato rot, L. HECKE (*Jour. Landw. 46 (1898), Nos. 1, pp. 71–74; 2, pp. 97–143, pls. 2*).—The author reports studies on the development of the fungus, paying considerable attention to the method of entrance into the host, spread of the disease, method of wintering the fungus, and means for combating the disease.

Remarks on sugar-beet diseases in the Province of Saxony during 1897, M. HOLLRUNG (*Ztschr. Ver. Deut. Zuckerind., 1898, No. 507, pp. 353–359*).

Potash manuring, especially with potassium carbonate, as affecting beet sickness, M. HOLLRUNG (*Ztschr. Ver. Deut. Zuckerind., 1898, No. 507, pp. 343–353*).

The anthracnose of ficus leaves, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 521, p. 1287, figs. 2*).—The author figures and describes an anthracnose (*Glœosporium elasticæ*) of the leaves of rubber plants. The treatment recommended is the removal of all spotted leaves. The same or a similar fungus is said to attack crotons, dracænas, and other plants, and it is liable to spread through a greenhouse unless checked.

The fusarium disease of potatoes, WEHMER (*Ztschr. Spiritusind., 21 (1898), No. 48–49*).

A reply to Frank's article on "A new potato disease," P. SORAUER (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 6, pp. 236–242*).

The mildew of Syringa vulgaris in North America, P. MAGNUS (*Ber. Deut. Bot. Gesell., 16 (1898), No. 3, pp. 63–70, pl. 1*).—The author calls attention to a common Microsphæra on Syringa in this country which seems to have been mistaken for *M. friesii.*

The carnation fairy ring fungus, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 520, p. 1256, fig. 1*).—This disease is attributed to attacks of *Heterosporium echinulatum.* It may be controlled by spraying plants with a solution of potassium sulphid.

Specimens of diseased plants, etc., F. T. BIOLETTI (*California Sta. Rpt. 1895–1897, pp. 237–242, pl. 1, fig. 1*).—Notes are given on a number of diseased plants which were sent in for identification. The cause of the trouble in each case is given and suggestions offered in many cases for the prevention of the disease. One of the most serious diseases reported upon is the tuberculosis of olives, which has been reported upon in Bulletin 120 of the station (E. S. R., 10, p. 55).

Literature of fungus diseases, W. C. STURGIS (*Connecticut State Sta. Rpt. 1897, pp. 182–222*).—A provisional bibliography of the more important works published by the U. S. Department of Agriculture and various agricultural experiment stations of the United States from 1887 to 1897, inclusive, on fungus and bacterial diseases of economic plants. The general arrangement of the subject is as follows: The host plants are arranged alphabetically, and under the name of each host plant are also arranged alphabetically the common names of the fungus diseases recorded as affecting that plant References to descriptions and illustrations either of the fungus itself or of its effect upon the host plant follow, and finally suggestions for treatment if any have been recommended The author has devoted considerable study to the subject, and has listed only those publications which he is convinced give the best descriptions, illustrations, or treatments which have been tested.

In addition to the bibliography outlined in the preliminary paragraph, a bibliography of 100 publications (mostly foreign) relating to plant disease is given.

Treatment for preventing smut, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, p. 170*).—Reports the beneficial use of the hot-water treatment of seed wheat for the prevention of smut.

Remedy for fungi and insects, C. W. WOODWORTH (*California Sta. Rpt. 1895–1897, pp. 213–233*).—The author popularly describes injurious fungi and insects and suggests remedies for the prevention of their attacks. Numerous fungicides and insecticides are described and formulas given for their preparation.

Notes on the preparation of fungicides, L. DEGRULLY (*Prog. Agr. et Vit., 29 (1898), No 19, pp. 577–581*).—Formulas are given for the preparation of a number of the better known and most efficient fungicides and explicit directions for their compounding.

ENTOMOLOGY.

Report of the apiculturist, R. F. HOLTERMANN (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 235–244, figs. 3*).—The report is of a miscellaneous nature, the more interesting facts of which are the success in the plan of cutting the combs of the brood chamber, thus allowing of ready communication between the different parts of the clustering swarm, as described in the last report; the confirmation of experiments on foul brood made during the previous year, demonstrating that the germs are completely destroyed by the process of foundation making; the failure of Carniolans to produce satisfactory combs unless given full sheets of foundation; the fact that in healthy cellar wintering there is no brood rearing, and that stores in the brood chamber may be moved to the supers to such an extent as to greatly injure the quality of the honey in the latter.

An experiment is noted on the value of pure air ventilation and artificial heat in wintering. A cellar was partitioned off into four rooms, at the end of one of which was placed a stove, the pipe from which ran through all four rooms. The temperature on February 14 of room 1 was 38° F., rooms 2 and 3, 40°, and room 4, 42°. The bees in the first cellar were much the most quiet. In the last they were the most restless all through the winter. The whole of the 300 colonies, with the exception of several starved and mice-destroyed colonies, all came through successfully. Although the passage of air from room to room is not desirable, the beneficial feature of currents of pure air and the maintenance of a steady low temperature is demonstrated.

Other subjects noted are the superiority of a bee space between sections in supers; the success of moving bees to fall pasture; the importance of filling sections to sides and bottom with foundation, thus preventing the formation of pop holes; and the superiority of foundation running 12 ft. to the pound over thinner kinds, since in the latter the bees show a tendency to cut holes.

Report of the department of entomology, V. H. LOWE and F. A. SIRRINE (*New York State Sta. Rpt. 1896, pp. 522–635, pls. 25*).—The report is divided into two parts; the first by V. H. Lowe, the second by F. A. Sirrine. After an introduction by the former, in which the principal lines of work are explained and the number of specimens in the station collection and the objects of the collection noted, the more important of various insects and their ravages are discussed.

Some of the more important injurious insects of the year (pp. 525–535).—Under this head there are noted the locusts (*Melanoplus femoratus*, *M. femur-rubrum*, and *M. atlanis*); striped cucumber beetles, the injuries of which have been of considerable importance in the western part of the State; asparagus beetles (*Crioceris asparagi* and *C. 12-punctatus*); aphids (*Myzus ribis* and *Rhopalosiphum ribis*), over 50 per cent of the former being noted as destroyed by parasites and spiders; red spider (*Tetranychus telarius*), which injuriously affected the raspberry bushes in Ulster County, New York, where they were shaded by trees, and also seriously injured currant bushes; chinch bug, (*Blissus leucopterus*), Putnam scale (*Aspidiotus ancylus*), and oyster-shell bark louse (*Mytilaspis pomorum*). The latter is not satisfactorily destroyed by kerosene emulsion unless the trunk is first well scraped and the emulsion applied in full strength with a stiff brush. Cankerworms were more abundant than during the previous year, mainly on account of remedial measures not being taken early enough nor continued with sufficient thoroughness.

Experiments with green arsenite (pp. 536–539).—Several experiments are noted with green arsenite or Sheele's green, which resulted in showing that the green arsenite will remain suspended in water for a longer time than Paris green, and hence can be applied more evenly to the foliage and requires less stirring in the tank, and that it will not

burn the foliage of potato vines when used without lime in the strength of 1 lb. to 150 gals. of water. Experiments show further, although the author does not conclude that Sheele's green is as effective as Paris green, that it has a very considerable insecticidal value. Experiments were made on basket willows, nursery stock, and potatoes, the solutions varying in strength from 1 lb. to 100 to 150 gal. of water.

Experiments with dendrolene (pp. 540–542).—Several experiments were made with this substance with the object of ascertaining whether trees are apt to be injured by its use and how it is to be used. It was applied to the trunks of trees in rings both high and above the ground and also at the base of the tree in both thick and thin layers. Where it came in contact with the soil it was found that it became granular, losing its sticky character to a large extent. When exposed to the weather a slight crust forms over it, which is not, however, sufficiently strong to permit the passage of insects as large as the female cankerworm moth. When applied to full-grown apple trees no injury resulted, but when applied during the growing season to the trunks of young bearing plum, cherry, or peach trees in such a way as to cover the entire trunk there is considerable danger of serious injury.

Combating the cottonwood leaf beetle (pp. 543, 544).—Experiments were made with green arsenite at the rate of 1 lb. to 150 gal. water, with and without the addition of lime, at the rate of 2 qt. to 45 gal., and with and without the addition of glue and of glucose. It was demonstrated that one of the most serious difficulties in the application of poisons to willows for this beetle lies in the fact that the mixture does not spread well on the willow leaf. Arsenite of lead did not adhere well, nor did an addition of glucose aid matters much. An addition of glue was more successful.

The pistol-case bearer (pp. 545–557, pls. 3).—A reprint of Bulletin 122 of the station (E. S. R., 9, p. 257).

A brief report of nursery stock inspection in western New York (p. 558).—Here it is noted that between 15,000 and 20,000 trees were inspected, about 3,000 of which were found infested with insects, mostly either by the peach-tree borer or the woolly aphis. Over 1,000 trees were rejected as worthless; the remainder were treated with insecticides. Each tree was carefully examined from the root to the top and only such as showed no evidence of insect work or disease were considered satisfactory. In addition to the insects noted there were found the oyster-shell bark louse, the scurfy bark louse, *Asterodiaspis quercicola*, and the pear-tree psylla.

The peach-tree borer (pp. 559–569, pls. 2).—An historical account of this insect (*Sannina exitiosa*), its distribution, the nature of its injury, its life history, and preventive and remedial measures, together with a partial bibliography.

The woolly louse of the apple (*Schizoneura lanigera*) (pp. 570–582, pls. 3).—The account given of this insect is similar in scope to the

last, but notes in addition the importance of the insect as a pest to nursery stock. The destruction of old apple trees is advised, as also the insecticides strong soap suds, kerosene emulsion, and hot water. Several pages are devoted to a bibliography.

Notes on the recent army worm outbreak (pp. 583–607, pls. 4).—A reprint of Bulletin 104 of the station (E. S. R., 8, p. 609), with the addition of an extended bibliography.

Miscellaneous notes of the season (pp. 608–619).—In this, the beginning of part second, the author notes briefly that experiments on cucumbers indicate that they can not be protected from attacks of the striped cucumber beetles by the use of either poisoned Bordeaux mixture or even poisoned resin-lime mixture; that the Colorado potato beetle will not feed on potato vines that have been thoroughly treated with Bordeaux mixture, and that the vines are also probably free from attacks of the flea-beetle; that the squash borer can probably be entirely controlled by the cultural methods of harrowing the ground in the fall where the squash vines rest and uniform spring or even fall plowing to a depth of 6 or 8 in. and not replowing; that onion thrips may be controlled by planting a few rows of set onions on the margins of fields and spraying these every week or 10 days with kerosene emulsion, and that the red spider may be treated by gathering in the fall the leaves affected by it and burning them, and by spraying in the spring with a solution of whale-oil soap or with kerosene emulsion. The various experiments are given more or less in detail.

The pear midge (*Diplosis pyrivora*) is also discussed. Experiments were made with kainit, which was applied at the rate of 1,500 to 2,000 lbs. per acre. The author states that the experiments show that there is a decided gain in the use of kainit, but there is a question to be solved, namely, how long an orchard will stand an application of the fertilizer at the rates noted, especially where the orchard is on a tenacious clay soil; and he suggests the question whether plowing an orchard in midsummer will not be fully as discouraging to the midge as an application of potash salt. It is thought that the latter method is far preferable to the former. According to the observations made, the midges appear April 15 to 30, pair as soon as they rise from the ground, lay their eggs, and die within 24 hours.

Notes on the cabbage plusia and remedies for the same (pp. 620–628).—In summarizing the experiments in regard to this insect (*Plusia brassicæ*), which are given more or less in detail, it is noted that the most practicable way of checking its work on lettuce is to keep the ventilators of forcing houses closed by means of mosquito netting. Where the insect affects cabbage in the open field poisoned resin-lime mixture or poisoned Bordeaux mixture to which resin mixture has been added may be employed. The resin-lime mixture was found to make Paris green and London purple adhere not only to the upper, but also to the lower, sides of the leaves.

Notes on remedies for cutworms (pp. 628–635).—Cutworms are discussed in their relation to the onion crop. The treatment found effectual was dried bran or middlings mixed with Paris green at the rate of 1 lb. of the latter to 50 of bran or 30 of middlings. Experiments were also made with Paris green added to resin-lime mixture, used as a spray. It was found to be more or less ineffectual. Relative to the amount of damage done, the highest noted is 99 per cent. The life history and habits are briefly touched upon and the belief expressed that the eggs of the insects are deposited later in the fall than is generally supposed, and that they do not hatch until the following spring.

Entomological section, H. OSBORN and E. D. BALL (*Iowa Sta. Rpt. 1896–97, pp. 112–125, pls. 5*).—The author briefly notes that the army worm did not occur in injurious numbers during 1897, an outbreak of the Hessian fly in the northwestern part of the State, plums as being in some cases seriously affected with plant lice, and the appearance of the San José scale in the State, and considers the life histories of leaf hoppers the principal subject of investigation during the year. The three species noted as affecting garden crops are *Agallia punctata*, *A. novella*, and *A. sanguinolenta*. Referring to the genus generally, the author states that—

"The species are very difficult of separation and little has been published in regard to their food habits or life histories. During the past season the three following species have been under observation and their larvæ and the general facts of their life histories determined. In order to correctly determine the species under observation, as well as those sent in from other States for determination, a systematic study of the genus was undertaken, the complete results of which will be published elsewhere. The genus was found to be separable into three groups, of which the three species treated are typical illustrations as far as structural characteristics of the adults are concerned, and the known facts in regard to the larvæ and life histories of the other species indicate that they, too, will be found to be very similar within the groups. In general, the species were found to be widely and generally distributed and subject to little variation except in depth of color. The three species treated, though by no means limited to that area, are all that are now known to occur in the northern and eastern part of the United States, while in the Southern States *constricta* replaces *4 punctata* and extends along the Atlantic coast to New York, but it is in the Southwestern States and down into Central America that the majority of the species occur. The species are all single brooded, in northern latitudes at least, and the larvæ agree in feeding on stems near the ground and hiding under rubbish."

The first species, *A. punctata*, appears to be naturally an inhabitant of shady woods, feeding upon various species of Compositæ, Cruciferæ Chenipodiaceæ, etc. Its taste for horse-radish, cabbage, spinach, and sugar beets gives it economic importance. The remedy recommended is kerosene emulsion spray.

The second species is merely described. The third is noted as preferring open sunny localities and occurring in great abundance in most all places except damp and shady woods. Clovers, especially white clover, a large number of weeds, and sugar beets are objects of its attacks.

The species noted as affecting orchard and shade trees are *Macropsis apicatis*, *Bythoscopus distinctus*, *Pediopsis tristis*, *P. trimaculata*, *P. viridis*, *P. ferruginoides*, *Idiocerus alternatus*, *I. brunneus*, *I. monoliferæ*, *I. verticis*, *I. snowi*, *I. maculipennis*, *I. provancheri*, and *I. cratægi*. The first (*M. apicatis*), the author states—

"May be so plentiful as to give a rough appearance to the bark in places, and, while not apparently producing distortion of the twigs, probably because they are placed so close to the surface as not to affect the growing tissue, the fact that many of the twigs affected are deadened at the tip would indicate possible injury in this manner. The eggs occur mainly on the under surface of the twig, but whether this position is to give the egg more uniform conditions by protecting it from direct sunlight or to the avoidance of strong light by the adult, or some other reason, is a matter of conjecture. The deposition of the summer eggs has not been observed, but it doubtless coincides with that for the winter brood.

"The larvæ are stout and short, similar in color and shape to the adult, but entirely covered with coarse bristle-like hairs, rendering it easily recognizable. Larvæ and adults were found in abundance on the new growth at the end of the twigs of honey locust toward the end of June, occurring in hundreds on a single tree, and although isolated trees, trees in hedgerows, and those in the native timber were examined, as well as others in different parts of the State, none were found entirely free from this insect. The larvæ had all issued by the last of the month."

The second (*B. distinctus*) occurs on black walnut, butternut, and on hickory and hackberry where they are adjacent to the first-mentioned tree. Full-grown larvæ are found during the second week in June and a second brood appears before the middle of August.

The species of Pediopsis are only briefly noted, but they all agree in being tree feeders, both as larvæ and as adults. *P. tristis* appears to be confined to plum trees and is often accompanied by *P. trimaculata*, which often exceeds the former in numbers. The most common species is *P. viridis* affecting most all the willows. The remaining species, *P. ferruginoides*, attacks the narrow-leaved willows.

Monograph of the Phymatidæ, A. Handlirsch (*Ann. K. K. Naturh. Hofmus., Wien, 12 (1897), pp. 127–230, pls. 6, figs. 35*).—The work is divided into 3 parts. The first part deals with the questions of literature, morphology, anatomy, embryonic development, life history, geographical distribution, as well as the systemic position and relationships of the family. The Phymatidæ, especially considered as approaching the Aradidæ and Tingitidæ, the author, for morphological reasons, places in the neighborhood of the Reduviidæ. Their closest relatives are thought to be the Stenopodinian genera, Phimophorus and Aulacogenia.

The family is distributed over the palearctic, oriental, and neotropical regions. Some three-fourths of the known species belong to the New World. None are found to occur in Australia, Africa, or Madagascar. The 2 species of Phyneata described by J. Scott as from New Zealand are thought very uncertain.

The second part of the work is entirely systematic. Nine genera and 73 species are recognized, and of these 3 genera and 29 species are new. Three natural groups are recognized: Phymatinæ with 1, Macrocephalinæ with 6, and Carcinocorinæ with 2 genera. The 3 new genera, Cnizocoris, Glossopelta, and Agrenocoris, belong to the second group.

Report of the professor of biology and geology, J. H. Panton (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 11–24, figs. 15*).—This notes briefly some 13 injurious insects and new fungi, with brief popular statements in each case as to proper

remedy. A somewhat lengthy note on the pernicious scale, which has appeared in the Province, besides mentioning something of the marvelous reproductive powers of this insect in the United States; notes on 3 classes of remedies applied to it, namely, corrosive washes, such as whale-oil soap, penetrating substances, such as kerosene emulsion and gases, and varnishes, such as resin washes. There are also given brief instructions as to spraying mixtures, note being made of Bordeaux mixture, ammoniacal copper sulphate, Paris green, 1 lb. to 200 to 300 gal., hellebore, pyrethrum, and kerosene emulsion.

Entomology, W D. HUNTER (*Nebraska Sta. Rpt. 1897, pp. 27-30*).—The author briefly notes experiments with *Sporotrichum globuliferum, Empusa grylli*, and a bacterial disease of grasshoppers, commenting more or less favorably upon the effects of the first two and on insecticides. The latter were with carbon bisulphid, concerning which it is thought that the different conditions under which it may be effectively employed are not well known, and the experiments were undertaken to learn new methods of applying it, whereby the expense attending its use might be lessened. The substance was used against plant lice inhabiting cucurbitous plants, borers in peach trees, larvæ of May beetles in nurseries and young orchards, and some species, such as *Sitodrepa panicea*, which damage stored dry animal and vegetable matter.

Insect notes of the season, W. E. BRITTON (*Connecticut State Sta. Rpt. 1897, pp. 314-319*).—Descriptive and life history notes are given on the following insects, with an account of their injuries during the season and suggestions as to remedies: Apple curculio (*Anthonomus quadrigibbus*) on peach twigs; San José scale; "virgin" or "white ermine" moth (*Spilosoma virginica*) on hollyhocks; grapevine flea-beetle (*Haltica* (*Graptodera*) *chalybea*); a plant louse (*Pemphigus acerifolii*) on maples; a lily-stalk borer, closely resembling *Gortyna nitela*, and presumably that species; saw-tooth grain beetle (*Silvanus surinamensis*); meal snout moth (*Pyralis farinalis*), and plant lice. A technical description is given of the lily-stalk borer. The gypsy moth (*Ocneria dispar*) was reported from Hartford, but as all the specimens were destroyed the scientific accuracy of the report could not be determined. The author is inclined to believe, however, that the larvæ belonged to some of the more common species and not to the moth imported from Europe.

Some new spiders, N. BANKS (*Canad. Ent., 30 (1898), No. 7, pp. 185-188*).—*Pœcilochroa minuta* from Brazos County, Texas; *Cybœodes* (?) *incerta* from Salton, California; *Theridium subterraneum* from Washington, D. C.; *Nasticus cavicola* from Chiricahua Mountains, Arizona; *Erigone albescens* from Washington, D. C.; and *Philodromus pacificus* from Olympia, Washington.

The contests against grasshoppers in the delta of the Danube, E. REKALO (*Selsk. Khoz. i Lyesov., 187 (1897), Oct., pp. 99-126*).—Since the chief brooding ground of the grasshoppers devastating Bessarabia is at the delta of the Danube, the author recommends joint action of Russia and Roumania in combating the insects at the delta.—P. FIREMAN.

Insects injurious to Helianthus annuus, A. KRULIKOVSKI (*Selsk. Khoz. i Lyesov., 185 (1897), June, pp. 585-598*).

The San José scale (*Pennsylvania Dept. Agr. Bul. 34, pp. 45-49*).—A popular paper, quoting largely from P. H. Rolf (E. S. R., 9, p. 1068), from J. P. Smith and F. M. Webster.

Bordeaux mixture as an insecticide, J. H. PANTON (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, p. 24*).—Experiments were made with Bordeaux mixture on gooseberry bushes to test its efficacy as an insecticide. Three applications were given the bushes. Further experiments were conducted in spraying tent caterpillars with Bordeaux mixture and Bordeaux mixture with Paris green. The Bordeaux mixture seemed to have some effect as an insecticide, but the author believes that applications of limewater gave results similar to those of Bordeaux mixture. The addition of Paris green increased the efficiency of the mixture.

FOODS—ANIMAL PRODUCTION.

The composition of hay as affected by maturity, R. HARCOURT (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 31–38*).—During the seasons of 1896 and 1897 clover and timothy were cut at different stages of maturity, and during the last year alfalfa also. The clover was cut when the first blossom was just appearing, when a third of the blossoms had turned brown, and when the heads had all turned brown or were dead; the alfalfa when the plants began to bloom, when they were in full bloom, and when most of the blossoms had fallen, and the timothy when the heads began to appear, when the first blossoms had just fallen, and when the seeds were well formed.

Analyses are given of the different cuttings, together with the calculated yield of dry matter. A digestion experiment with one sheep was made with each cutting, and from the results the yield of digestible dry matter is calculated.

The results indicated that in each case the crop deteriorated and its digestibility decreased with maturity and that alfalfa contained the largest amount of digestible matter from early to full bloom. It is recommended that clover be cut when the heads begin to turn brown and timothy soon after the first blossoms fall. When alfalfa has reached its full bloom it deteriorates faster than clover or timothy.

Food value of California eggs, M. E. JAFFA (*California Sta. Rpt. 1895–1897, pp. 120–121*).—A comparison which included the physical properties and composition was made of brown-shelled and white-shelled hens' eggs. The brown-shelled eggs were from Partridge Cochins, Dark Brahmas, Black Langshans, Wyandottes, and Barred Plymouth Rocks; and the white-shelled from Brown Leghorns, Buff Leghorns, White Minorcas and Black Minorcas. The size, weight, specific gravity, and the ratio to total weight of the shell, yolk, and white are shown in the following table:

Comparison of brown-shelled and white-shelled eggs.

	Weight.	Length.	Width.	Specific gravity.	Number of eggs to lb.	Shell.	Edible portion.		
							Total.	Yolk.	White.
	Grams.	*Inches.*	*Inches.*			*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Brown shelled eggs (average of 6 breeds)	59.4	2.27	1.69	1.082	7.67	10.70	89.30	31.76	57.54
White-shelled eggs (average of 4 breeds)	62.9	2.27	1.76	1.058	7.33	10.92	89.08	33.18	55.90
Average of above	61.3	2.27	1.72	1.070	7.50	10.81	89.19	32.47	56.72

The composition of the eggs of the different breeds is recorded in detail. The averages are given in the following table:

Analyses of brown-shelled and white-shelled eggs.

	Water.	Protein.	Fat.	Ash.	Shell.	Total.	Fuel value per pound.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*
Brown-shelled eggs:							
Yolk	49.59	15.58	33.52	1.04	....	99.73	1,712
White	86.60	11.99	.21	.54	....	99.34	224
Entire egg	65.57	11.84	10.77	.64	10.70	99.52	670
White-shelled eggs:							
Yolk	49.81	15.49	33.34	1.05	....	99.69	1,696
White	86.37	12.14	.35	.56	....	99.32	240
Entire egg	64.79	11.92	11.22	.67	10.92	99.52	690

"It has been said by some that the brown eggs are richer than the white ones. This statement is not borne out by a chemical analysis, and the physical examination proves that the main points of superiority, although extremely slight, are possessed by the white eggs. The minute differences that are found between the two groups are exceeded by variation between the varieties within the same group.

"We can therefore state as a conclusion, both from a chemical and a physical point of view, that there are practically no differences, so far as the food value is concerned, between the white-shelled and brown-shelled eggs."

Report of the chemical department, H. A. HUSTON (*Indiana Sta. Rpt. 1897, pp. 16–21*).—Brief statements are made concerning the work of the station on sugar beets, fertilizer experiments on clay soils, experiments on the prevention of root rot, and laboratory studies on available plant food in worn soils. Many samples of cheese purchased in the open market were examined, but no filled cheese was found. "The cheap cheese that has taken the place of the filled cheese contains very little fat and the casein [when tested by methods of artificial digestion] seems to be in such a condition as to offer great resistance to digestive ferments." Analyses are reported of linseed meal, cotton-seed meal, silage from corn stover, purslane, rye middlings, buckwheat middlings, Idaho coffee pea, malt sprouts, wheat, strawboard waste (fertilizing constituents), and marl.

The analyses of purslane, Idaho coffee pea, and strawboard waste are given in the following table:

Composition of purslane, Idaho coffee pea, and strawboard waste.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.	Total nitrogen.	Phosphoric acid.	Potash.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Purslane (*Portulaca oleracea*)	86.56	1.81	0.50	6.49	2.12	2.23	0.29	0.045	0.85
Idaho coffee pea	6.75	15.37	6.56	65.53	2.47	3.28	2.46	......	......
Strawboard waste	69.67	......	......	......	......	......	.32	.21	.14

The purslane contained 0.23 per cent albuminoid nitrogen and 0.06 per cent amid nitrogen, and the Idaho coffee pea 2.32 per cent and 0.14 per cent of these constituents.

"The purslane compares favorably with average samples of corn fodder so far as the protein and ether extract are concerned. Nitrogen-free extract is rather lower than in most green fodder, but the amount of water is considerably higher. The ash is higher than any ash that I have seen reported in green feeding stuffs. Owing to the relatively low amounts of fiber and nitrogen-free extract, the nutritive ratio is high, being about 5.5. The material has been used to some extent in this State for many years as a food for pigs, and in many localities is highly esteemed. Analysis shows that it is well worth consideration as a feeding material for such animals as will eat it readily.

"The material has also a relatively high fertilizing value."

Brief statements concerning other analytical work are also made.

Investigation of California cattle foods, M. E. JAFFA (*California Sta. Rpt., 1895–1897, pp. 112–116*).—Analyses are reported of mixed feed, shorts, middlings, wheat bran, rice bran, linseed-oil cake, cocoanut-oil cake, bur clover, clover (*Trifolium wormskioldii*), malt sprouts, sugar-beet pulp, Egyptian corn, silage from sugar beet pulp, barley, clover, corn, and sugar beets. In every case the digestible matter in 100 lbs. was calculated.

The composition of a number of these feeding stuffs is shown in the following table:

Composition of California cattle foods.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.	Fuel value.	Nutritive ratio.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories.*	*Per ct.*
Cocoanut-oil cake	12.87	20.06	10.13	40.90	11.50	4.54	1,308	1:5.5
Do	14.68	19.16	10.53	42.81	8.55	4.27	1,290	1:3.3
Bur clover	8.95	13.65	3.60	38.22	30.58	5.00	965	1:5.3
Clover (*Trifolium wormskioldii*)	10.00	13.86	3.84	37.67	27.27	7.33	938	1:5.1
Sugar-beet pulp	90.00	1.25	.14	6.14	2.05	.42	164	1:6.7
Sugar-beet pulp silage	90.00	1.46	.39	4.70	3.14	.31	165	1:5.7
Barley silage	80.00	2.07	.79	7.53	7.50	2.11	234	1:7.7
Do	70.00	3.10	1.19	11.29	11.25	3.17	351	1:7.7
Sugar-beet silage	70.00	4.38	1.17	14.10	9.42	.93	495	1:5.7
Egyptian corn *a*	12.63	9.96	3.86	69.70	1.93	1.92	....	....

a Average of Common White, Red, and Jerusalem.

Analyses of feeds, A. L. WINTON, A. W. OGDEN, and W. L. MITCHELL (*Connecticut State Sta. Rpt. 1897, pp. 319–321*).—Analyses are reported of chaff, oat feed, "Oatena," corn and oats, corn meal, corn-meal germ, gluten feed, mixed feed, and hay of the flat pea (*Lathyrus sylvestris*). The percentage composition of the "Oatena" was as follows: Water, 7.12; protein, 8.75; fat, 4.03; nitrogen-free extract, 59.16; fiber, 16.19, and ash, 4.75. The composition of *Lathyrus sylvestris* hay was as follows: Water, 10.25; protein, 26.84; fat, 3.81; nitrogen-free extract, 28.27; fiber, 26.51, and ash, 4.32.

The method of establishing a meadow of flat peas by seeding and transplanting is described. This season about one-fourth of an acre,

grown in part from seed sown in 1895 and in part from plants transplanted in 1896, yielded nearly a ton of hay from two cuttings.

Different quantities of meal for fattening steers, E. G. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 81–83*).—A test was made with one lot of 3 and two lots of 2 steers of medium quality to compare light and heavy grain rations. After a preliminary period of 3 weeks the experiment proper covered 216 days, ending July 8, 1897. The lots were fed at first all the straw they would eat morning and evening, with 10 lbs. of hay at noon, and later all the hay they would eat. They were also given at noon 20 to 25 lbs. of turnips. During the latter part of the test, however, 14 to 20 lbs. of silage was substituted for turnips. All the steers were fed grain consisting of equal parts by weight of peas, barley, and oats, the plan being to increase the amount fed until lot 1 was given 1 lb. per day for every 100 lbs. live weight, lot 2 $\frac{2}{3}$ lb., and lot 3 $\frac{1}{3}$ lb. Before the close of the test lot 1 consumed 12 lbs. of grain per day. The heavy grain ration was consumed in three portions and the light ration in two portions.

The financial statement is based on meal at $13, hay at $6, straw at $3, silage at $2, and roots at $2 per ton.

The results of the test are shown in the following table:

Results of feeding heavy and light grain rations to steers.

	Average weight at beginning.	Average gain per day.	Net profit per steer.
	Pounds.	*Pounds.*	
Lot 1 (heavy ration)	900	1.80	$9.62
Lot 2 (medium ration)	1,000	1.77	14.50
Lot 3 (light ration)	988	1.56	13.64

"The heavy-ration steers made the greatest gain, but gave the smallest profit, the largest profit being obtained from the medium-ration steers."

The steers were sold and the meat judged by an expert. Definite conclusions are not drawn.

Comparison of sweet and sour whey for pigs, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 85–88*).—In continuation of previous work (E. S. R., 9, p. 487) three experiments were made to test the comparative value of sweet and sour whey for fattening pigs. The first test was made with three lots of 3 pigs each. During the preliminary period all the pigs were fed the same amount of sweet whey and grain. The quantity of whey was at first small and was gradually increased. During the experiment proper sour whey was substituted for sweet whey in the ration of lot 2 and water for whey in the ration of lot 3. The pigs were given all they would eat. The whey and grain were fed in the proportion of 2:1. The grain consisted of equal parts by weight of barley, peas, and shorts.

At the beginning of the test the three lots weighed 374, 377, and 377

lbs., respectively. During the preliminary period of 7 days the average daily gain per pig for the three lots was 1.24, 1.29, and 1.52 lbs. During the experiment proper (29 days) the average daily gain per pig for the three lots was 1.38, 1.26, and 1.35 lbs. Lot 1 consumed 3.36 lbs. of grain and 6.17 lbs. of whey per pound of gain; lot 2, 3.70 lbs. of grain and 6.79 lbs. of whey; and lot 3, 4.28 lbs. of grain per pound of gain.

The second test was begun with three lots of 3 pigs under the same conditions as the first. However, it was necessary to drop lot 1 before the close of the test. Lot 2 (fed sour whey and grain) weighed 230 lbs. at the beginning of the test and made an average daily gain per head of 1.26 lbs. during the preliminary period of 14 days. Lot 3 (fed grain and water) weighed 227 lbs. at the beginning and during the 14 days made an average daily gain of 1.31 lbs. During the experiment proper, which continued 64 days, lot 2 made an average daily gain of 1.36 lbs., consuming 3.48 lbs. of grain and 6.96 lbs. of whey per pound of gain. During the same period lot 3 made a daily average gain of 1.41 lbs. and consumed 4.18 lbs. of grain per pound of gain.

The third test was made with the same number of pigs and under the same conditions as the first. The three lots weighed 290, 295, and 289 lbs. and during the preliminary period of 10 days made an average daily gain of 1.76, 1.50, and 1.70 lbs. During the experiment proper, which covered 31 days, lot 1 made an average daily gain of 1.87 lbs., consuming 3.54 lbs. of grain and 6.09 lbs. of whey per pound of gain. The corresponding figures for lot 2 are 1.96 lbs. gain and 3.37 lbs. grain and 5.79 lbs. whey; and for lot 3, 2.07 lbs. gain and 3.91 lbs. grain per pound of gain.

The pigs were sold and the meat judged by an expert. No bad effects attended the use of whey. Somewhat better gains were made on sour whey than on sweet whey.

Comparison of different breeds of swine, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 88–90*).—In continuation of work previously reported (E. S. R., 9, p. 478) a test was made with 6 lots of 6 pigs each to compare the following breeds: Improved Yorkshire, Chester-White, Duroc-Jersey, Tamworth, Poland-China, and Berkshire. But one breed was represented in each lot. A record was kept of the food consumed and the gains made by the different lots between the ages of 90 and 180 days. All the pigs were fed grain of some sort, but detailed statements as to the feeding stuffs used and the methods of feeding are not given.

The gains made during 90 days and the food consumed per pound of gain for the different breeds are shown below:

Results of feeding pigs of different breeds.

Breed.	Average weight at beginning.	Average daily gain per pig.	Grain consumed per pound of gain.
	Pounds.	*Pounds.*	*Pounds.*
Berkshire	53.00	1.02	3.27
Tamworth	52.00	.97	3.31
Poland-China	52.33	.84	3.33
Chester-White	51.66	.83	3.40
Yorkshire	60.33	.93	3.41
Duroc-Jersey	64.66	.94	3.58

The breeds are arranged in the table in the order of economy of gain, but in the author's opinion the experimental data are not sufficient for general conclusions. The pigs were slaughtered and the flesh of representatives of each breed judged by an expert as regards its suitability for export bacon. General deductions on this point are not drawn.

Feeding trials with crossbred swine, W. P. WHEELER (*New York State Sta. Rpt. 1896, pp. 658–665*).—A tabular record is given of feeding five lots of crossbred pigs from birth until time of marketing, when 7 months old. The sow was fed with each lot until the pigs were 8 weeks old. The several lots were given like rations at similar stages of growth. For the first 4 weeks, wheat bran was fed with skim milk, which latter always formed part of every ration. During the second period of 4 weeks, a mixture of equal parts of wheat bran and wheat middlings was fed. Other grain mixtures, containing corn meal in increasing proportions, followed.

Rating wheat bran at $18 per ton, corn-meal middlings at $20 per ton, and skim milk at 25 cts. per hundred pounds, the cost of the gain in weight of the different crosses during the 28 weeks was as follows: Tamworth-Duroc cross, 3.83 cts. per pound; Yorkshire-Tamworth, 3.25 cts.; Tamworth-Poland China, 3.44 cts.; Ohio Improved Chester-Poland China, 3.61 cts.

After the pigs were removed from the sows, the cost of food per pound of gain for the different lots was: Tamworth-Yorkshire cross, 2.48 cts.; Tamworth-Duroc, 2.41 cts.; Yorkshire-Tamworth, 2.17 cts.; Tamworth-Poland China, 2.33 cts.; and Ohio Improved Chester-Poland China, 2.37 cts. "It will be seen from these figures that there was little difference in the efficiency with which each lot utilized the food."

A considerable difference was observable in the rapidity of growth of the different crosses. The Tamworth-Poland China pigs at the end of the test averaged 262 lbs. each. This was 11 per cent heavier than the average of the Yorkshire-Tamworth cross, the lot nearest them in size, and over 36 per cent heavier than the Ohio Improved Chester-Poland China cross.

The fecundity of swine, A. W. BITTING (*Indiana Sta. Rpt. 1897, pp. 42–46*).—According to the author the impression is prevalent that pure-bred swine are unprofitable for breeding purposes, as it is thought that as the breed is improved fecundity decreases. The author compiled the number of pigs farrowed and raised in the first and last 200 litters recorded in registers of Berkshire, Poland-China, and Chester White pigs. These are quoted in detail. The popular opinion is not confirmed by this investigation.

"While there seems to be a reduction in the number of very large litters, the total number farrowed is about the same as shown by the first records.

"It is not the intent to compare breeds, but to compare the earliest and latest records of litters to determine whether there has been a real gain or loss in the fecundity of the breed.

"The number of boars and sows raised was as follows: Berkshire, 400 litters, 2,866 pigs, 1,498 boars, 1,368 sows; Poland-China, 1,000 litters, 6,542 pigs, 3,228 boars, 3,314 sows; Chester White, 600 litters, 4,555 pigs, 2,236 boars, 2,319 sows. In a total of 3,693 pigs farrowed and all raised, there were 1,786 boars and 1,907 sows."

Report of the poultry manager, L. G. JARVIS (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 223–231, figs. 11*).—General statements are made concerning the diseases and animal parasites of poultry, testing of eggs, development of chickens, etc. The value of different foods is discussed, and several different winter rations are suggested. The protein, phosphoric acid, and calcium oxid in fresh green bone, meat meal, and dried-blood meal were determined.

A test was made of the keeping quality of fertile and infertile eggs. Four dozen fertile and three dozen infertile eggs were placed in an egg closet the middle of July, 1897, and kept at a temperature of 50 to 60°. The eggs were laid on the sides in bran and were not turned. At the end of a month no perceptible difference was observed in the two kinds of eggs. This was also the case the middle of September. A month later it was observed that the whites of the fertile eggs were more watery than those of the infertile eggs. No difference was observed, however, in the yolks. At the conclusion of the test (the middle of November) the whites of the fertile eggs were watery and in some cases the yolks were broken. When this was not the case, they were much spotted and discolored and the eggs totally unfit for table use. The infertile eggs were in good condition. The whites and yolks had a normal appearance and no tendency toward decay was observed. In the author's opinion the eggs were of as good quality as the average commercial product, though inferior to new-laid eggs. Experiments along this line will be continued.

Brief notes are given on crossbreeding tests made during the season. The information which was furnished in reply to requests received during the year is quoted.

Second report on food products (*Connecticut State Sta. Rpt. 1897, pp. 1–64*).—This contains the text of the Connecticut food law of 1895, and reports on the examination of food products in accordance with the provisions of the law. Samples of the fol-

lowing foods and condiments were analyzed during the past year: Black, white, and cayenne pepper, allspice, cinnamon, cloves, coffee, date-stone coffee, catsup, Chile sauce, honey, maple sirup, confectionery, sausage, mince-meat, head cheese, codfish, olive oil, oysters, milk, vinegar, molasses, sirup, cream, butter, and imitation butter. Of the samples examined 695 were not adulterated, 209 were adulterated, and 93 contained borax, salicylic acid, or benzoic acid.

Human food, J. KÖNIG (*L'alimentation humaine. Paris, 1898*).—Tables showing the composition of human foods, translated by X. Rocques.

List of publications of the Office of Experiment Stations on the food and nutrition of man (*U. S. Dept. Agr., Office of Experiment Stations Doc. 238 (rev.), pp. 4*).

Qualitative and quantitative determination of wheat flour in rye flour, S. WEINWURM (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 2, pp. 98–101*).

Sugar as a feeding stuff for animals in the region about Paris, J. BRUHAT (*Jour. Hyg., 23 (1898), No. 1132, pp. 253–256*).—A general article pointing out the value of sugar and molasses as feeding stuffs. Many references are made to recent work on the subject.

Concentrated feeding stuffs for sheep, N. DYUMIN (*Selsk. Khoz. i Lyesov., 184 (1897), No. 3, pp. 673–683*).—Tests were made to determine the feeding value of cotton-seed hulls, corn, and bran, with hay and straw, using 80 sheep divided into 8 equal lots. The test lasted from December 23 until April 4. The gains in weight were recorded. On this basis the best results were obtained with a ration of corn and wheat straw, followed by corn and hay, bran and hay, cotton-seed hulls and hay, bran and straw, hay alone, cotton-seed hulls and straw, and straw, in the order mentioned.—P. FIREMAN.

The utilization of cocoa shells, G. PARIS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 6, pp. 389, 390*).—The composition of cocoa shells and a decoction made from them is reported.

Do coffeon and caffein-free coffee surrogates produce the effect of coffee? K. B. LEHMANN and F. WILHELM (*Arch. Hyg., 23 (1898), No. 4, pp. 310–326*).—Coffeon is a product obtained by condensing the material volatilized when coffee is roasted. Experiments were made with man with coffee, caffein, coffeon, coffee distillate, an ether extract of coffee, coffee surrogates, fig coffee, and chicory. The principal conclusions follow: The pleasant flavor of coffee is due to coffeon. None of the toxic effects which follow large doses of coffee could be attributed to this. Neither fig coffee nor chicory produced any effect.

Do the volatile aromatic constituents of tea (tea oil) produce a noticeable effect on man? K. B. LEHMANN and B. TENDLAU (*Arch. Hyg., 23 (1898), No. 4, pp. 327–352, dgms. 3*).—Experiments were made with man on the effect of the volatile extract of tea obtained by distillation with steam and the material obtained by extraction with water or by extracting the dry tea with ether. In the authors' opinion the flavor of tea is due to the oil, i. e., volatile material, but it has scarcely any other effect.

The energy expended in bicycle riding, SEHRWALD (*Arch. Hyg., 23 (1898), No. 4, pp. 353–410, tables 2*).—An extended study of the energy expended in riding a bicycle under various conditions. A formula for calculating the energy from a number of factors which may be measured is given.

The chemical analysis of the gastric contents, H. E. HEWES (*Boston Med. and Surg. Jour., 1897, Nov. 25 and Dec. 2; reprinted in Amer. Jour. Pharm., 70 (1898), Nos. 1, pp. 25–44; 2, pp. 94–109*).—The author gives in detail the method of analysis of the products of gastric digestion, and reports analyses of the gastric contents of 50 healthy individuals. The article also contains general information on digestion and many references to the literature of the subject.

The poisonous action of urine, A. BECK (*Arch. Physiol. [Pflüger], 71, No. 11–12, pp. 560–595*).

On mucus in human feces, A. SCHMIDT (*Ztschr. Klin. Med. [Berlin] 32, pp. 260–279, pl. 1*).—A somewhat extended study on the mucus in human feces. The subject is considered from a medical standpoint.

Live stock, W. RENNIE (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 217–220*).—Brief statements are given concerning the feeding and care of steers, milch cows, sheep, swine, and horses at the Ontario Experimental Farm during 1896–97. The amount and cost of the foods consumed by 11 steers and the price received for them are recorded. Comparative tests of the different feeds were not made.

"The steers and milch cows are fed a full ration morning and night of silage, pulped roots, clover hay and chaff, and chopped grain and bran. At noon they get only 25 lbs. of sliced roots. Under this system better results are obtained, and the animals are healthier than with three full feeds per day."

The average weight of the fleece of the different breeds of sheep is recorded.

The cost of cattle raising in Argentine Republic (*Mitt. Deut. Landw. Gesell., 1898, Nos. 9, Sup., pp. 66–72; 10, Sup., pp. 73, 74*).

Cattle raising in Argentine Republic (*Mitt. Deut. Landw. Gesell., 1898, No. 8, Sup., pp. 58–63*).

Sheep raising in Argentine Republic (*Mitt. Deut. Landw. Gesell., 1898, No. 8, Sup., pp. 57, 58*).

Horse raising in Argentine Republic (*Mitt. Deut. Landw. Gesell., 1898, Nos. 8, Sup., pp. 63, 64; 9, Sup., pp. 65, 66*).

Profitable poultry breeding for the local and English markets, G. BRADSHAW (*Sydney: New South Wales Dept. Agr., 1897, pp. 44*).

Feeding experiments with laying hens, W. P. WHEELER (*New York State Sta. Rpt. 1896, pp. 666–687*).—A reprint of Bulletin 106 of the station (E. S. R., 8, p. 819), with the addition of some detailed tabular data.

DAIRY FARMING—DAIRYING.

On the question of the processes of milk secretion, DISSELHORST (*Ztschr. Fleisch u. Milchhyg., 8, No. 8, pp. 146–150*).—This article is based upon investigations recently conducted by L. Michaelis in the laboratory of Prof. O. Hertwig in Berlin and published as an inaugural dissertation.

Michaelis reviews the literature of milk secretion and enumerates the following groups of questions which are still in doubt: (1) Is the constant change in the form of the separating epithelium of the glands dependent upon the activity of the secretion, or is it a mechanical result of the fullness of the alveolus? (2) Does a breaking down of the epithelial nuclei (which are always present in the first part of the secretion) take place; and, if this is the case, in what manner are these nuclei replaced? (3) What part do the leucocytes take in milk production? (4) Is the fat a product of the degenerated epithelial cells, or is it a secretion from these cells?

To answer these questions Michaelis made very comprehensive investigations on the milk glands of cows, guinea pigs, and mice in various stages of lactation. The lumen of the alveoli of pregnant animals contains immense leucocytes, which show amoeboid motion, and which often contain one or several drops of fat. These cells have only one nucleus and are, as will be seen later, of great importance in the formation of colostrum. The alveoli and the interstitial tissue also contain large numbers of polynuclear lymph corpuscles, which may also be

found between the individual epithelial cells. Eosinophil cells were likewise observed in large numbers.

An investigation of the contents of the mammary glands of pregnant guinea pigs for a period of 4 weeks showed an alternating occurrence of leucocytes and colostrum corpuscles; when both kinds were present all of the different transformation stages were observed. This gives rise to the question as to the origin of the colostrum corpuscles. Michaelis concludes that they consist of leucocytes, and especially of the mononuclear lymph corpuscles which have taken up fat globules. In no case do they result from a fatty degeneration of the leucocytes, as Rauber states, for in the first place they have a nucleus and in the second place they show amoeboid movements. This accounts for the mononuclear leucocytes, and the question arises as to the rôle of the leucocytes with several nuclei. Michaelis found that they break down after an active division of the nuclei has taken place.

The fate of a lymph corpuscle which penetrates the epithelium of the mammary glands is, therefore, (1) that either it increases in size, takes up fat globules, and becomes a colostrum corpuscle (always mononuclear), or (2) after enlarging slightly the nucleus breaks up and then the cell. As to the further fate of the colostrum bodies, Michaelis was not able to determine definitely; but the probability of their returning to the lymphatics, as suggested by Czerny, is excluded by their immensely increased size.

While the above refers to the condition of the mammary glands of pregnant animals before parturition, the glands of suckling animals present a totally different appearance. Here the interstitial connective tissue has been reduced to a minimum, the acidophile cells have disappeared, and also the lymphatic corpuscles in the connective tissue. There is hardly a leucocyte to be seen, but in their place clusters of free nuclei are observed in the secretion, which in all respects resemble the nuclei of the epithelial cells. Michaelis could plainly observe the expulsion of these nuclei, some of which still adhered to their cells. Other investigators have made similar observations, but the fact that karyokinesis had never been observed in the actively secreting gland made this one of the darkest points in the etiology of milk secretion. All are agreed, however, that the actively secreting glands contain a larger number of nuclei than the reverting ones. As to the origin of these nuclei, Michaelis was able to find polynuclear epithelial cells in which direct cell division was taking place. Indications of this appeared immediately after parturition, when nuclei of various sizes and shapes were to be seen. This had escaped previous observers. As a result of his discovery the statement is made that the innumerable nuclei which are present in the lumen of the milk ducts and alveoli are expelled by the epithelial cells, in which they are formed by direct karyokinesis. However, these nuclei do not occur in normal milk, as they are disintegrated through chromatolysis and form a homogenous mass of achro-

matic substances. In some cases this retrogressive change is apparent before the nucleus leaves the epithelial cell, although much the larger portion are intact when they reach the alveoli.

The form of the epithelial cells exhibits some very typical changes during lactation. According to Michaelis they are first cubical, then papilliform, then cubical again, and finally flat. It is quite possible that the albuminoids of milk are produced by these cells at certain stages of the secretion, when they protrude like papillæ into the lumen of the alveoli.

Until recently fat has been regarded as a result of a degeneration of the glandular epithelium. If this proposition were correct it would call for a double layer of epithelium in the secreting glands, while, as shown above, there is only one layer. Consequently the formation of fat in the mammary glands is not due to a degeneration of the glandular epithelium, as in the case of the sebaceous glands, but rather to an infiltration of fat which the epithelial cells extract from the circulating supply of blood and lymph. The epithelium secretes or separates the fat itself by extracting it out of the fluids (soaps) furnishing it, and no breaking down of the epithelium takes place.

Regarding the disputed question as to whether the fat globules are inclosed in a membrane, Michaelis concludes that they are not. Not the slightest trace of a membrane was found.

As milk sugar is not a morphological element of milk, it is considered impossible to determine its origin until further advancement has been made in micro-chemistry.

The casein, however, is evidently composed of albuminoid bodies secreted by the cells, and formed by disintegration of the nuclei. The latter process accounts for the nuclein content of milk shown by Heidenhain and Nissen.

Since, as shown above, only a few nuclei of the epithelial cells are broken down during the colostrum period, the chemical difference between milk and colostrum is explained; the milk contains more casein (including nuclein) and the colostrum more albumin.

Concerning the behavior of the mammary glands in the involution period, the most noticeable feature is the return to the production of colostrum. "The secretion of a guinea pig at the end of gestation can not be distinguished from that produced the day after the young have been weaned." The eosinophil cells appear again, leucocytes penetrate the epithelium in large quantities and break down in the alveoli or are transformed into colostrum bodies. This is true, no matter how long a time has elapsed since giving birth. The whole process of reformation of the glands takes place very soon after weaning; the alveoli materially diminish in size, and the interstitial connective tissue materially increases.

The results of investigations on this subject, especially those of Michaelis, are summarized by the author as follows:

(1) The epithelium of the mammary glands is composed of only one layer.

(2) The fat of milk is a true product of secretion—a product of the life activity of the cells and not a product of their degeneration.

(3) At the present time nothing definite can be said regarding the method of secretion of milk sugar.

(4) Casein is a compound product, derived partly from albuminoid bodies produced by the excreting epithelial cells, and partly from the disintegrated nuclei of these cells. The nuclein of milk is derived from the latter source.

(5) The fat globules are not inclosed in a membrane.

(6) The colostrum bodies originate from large, mononuclear leucocytes, capable of amœboid motion. These bodies reappear in the involution period of the glands. The leucocytes take no part in the production of milk, and the polynuclear ones disappear; but during gestation, immediately after birth, and for a short period after weaning, they pass through the epithelium in all forms and in great numbers.

(7) During lactation large quantities of free epithelial nuclei are found in the lumen of the alveoli, which decompose and assist in forming an integral constituent of the milk, namely, the casein.

(8) The pressure of the secretion in the alveoli may flatten the cubical cells, but at certain stages the cells of the mammary glands are papilliform. The latter condition is not due to the stage of fullness of the lumen, but indicates an independent change of form in the epithelium during lactation.

Analyses of milk, A. L. WINTON, A. W. OGDEN, and W. L. MITCHELL (*Connecticut State Sta. Rpt. 1897, pp. 321, 322*).—Analyses are reported of the mixed milk of 6 cows on the last day of each of 4 periods of 2 weeks' duration on different feeds. The feeding was not done at the station, but the samples were sent for analysis. In the first and third periods the cows were fed cut-corn fodder, hay and corn silage with a mixture of wheat bran and cotton-seed meal, 1:1. In the second and fourth periods the coarse fodder remained the same, but wheat bran and Cleveland linseed meal 1:1 were substituted for bran and cotton-seed meal in the proportion of 3 qt. to 2. During the linseed-meal periods the milk contained somewhat less fat and more water than during the other periods. No data are given as to the yield of milk.

Analyses of some California creamery butters, M. E. JAFFA (*California Sta. Rpt. 1895–1897, pp. 116–120*).—In order to compare California butter with premium butter from the American Dairy Show at Chicago, analyses were made of 6 samples of creamery butter from the bay region and 6 from Humboldt County. In addition, samples of

French and Danish butter were analyzed. The average results are shown in the following table:

Composition of butters.

	Water.	Fat.	Curd.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
California butter:				
Bay region (average of 6 samples)	10.55	85.05	1.44	2.99
Humboldt County (average of 6 samples)	11.42	84.15	1.06	3.37
Foreign butter:				
Danish	6.95	90.35	1.08	2.52
French	10.55	82.95	1.10	5.40

"We can safely say that as regards chemical composition the California butters are the equal in all respects of the Eastern product. . . .

"The sample of Danish butter analyzed could not have been a representative one, owing to the abnormally low percentage of water and high percentage of fat shown in the analysis."

The American and English methods of scoring butter are discussed.

Test of milk for tubercle bacilli, STORCH (*Milch Ztg., 27 (1898), No. 30, p. 472*).—To a spoonful of milk in a test tube a few drops of hydrogen peroxid are added and then a few drops of paraffinglendiaming ($C_6H_4 (NH_2)_2$). If the milk is free from tubercle bacilli there is no change in color, but if bacilli are present the milk is said to change immediately to a grayish green color on shaking.

Experiments in butter making, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 59–68*).—*Feeding silage to cows* (pp. 59–62).—In this experiment, lasting from May 6 to 26, the cows were divided into two lots of 10 each, one lot receiving 50 or 60 lbs. of silage per day with some uncut hay, and the other lot receiving 35 lbs. of silage with 10 or 12 lbs. of cut-clover hay and about $\frac{1}{3}$ bu. of mangel-wurzels. In addition both lots received 8 lbs. of mixed grain, consisting of equal parts of bran, peas, oats, and linseed meal. In all 13 different churnings were made. The cream from the silage lot was churned at a temperature ranging from 55 to 61° and averaging 57°, and that from the mixed feed lot from 54 to 61° and averaging 57°. The former churned on an average in $33\frac{1}{2}$ minutes, while the latter required 42 minutes. The butter was scored when about a month old, and again when over 2 months old, with the following results:

Scoring of butter made on silage and on mixed feed.

	Silage butter.			Mixed-feed butter.		
	Flavor. (Max. 45.)	Grain. (Max. 25.)	Total score. (Max. 100.)	Flavor. (Max. 45.)	Grain. (Max. 25.)	Total score. (Max. 100.)
First scoring	39.0	23.4	91.3	39.8	23.4	92.0
Last scoring	35.6	23.0	87.0	36.8	23.0	88.2
Average	37.7	23.2	89.7	38.6	23.2	90.4

"(1) The cream from silage feed churned more easily than that from mixed feed.

"(2) The highest score for flavor was 42 points out of a possible 45. Two lots of silage butter scored 42, and three lots of the other scored this number. In grain, 24 points was the highest score obtained from a possible 25. The silage butter scored 24 six times, and the mixed-feed butter 24 five times. According to the judgment of the expert, the flavor of the butter was slightly better from the mixed feed (0.8 of a point in the average of 13 trials), and it also held its flavor slightly better. The mixed-feed butter lost 2 points by keeping one month in an ordinary cool room, while the silage butter lost 3.4 points in flavor by keeping.

"We can recommend good corn silage for feeding cows to produce milk for butter-making, but would prefer having it mixed with other foods, rather than feeding it in large quantities by itself."

Effect on milk and butter of feeding turnips to cows (pp. 62–64).—In an experiment commenced in February, 1897, 6 cows were divided into three lots. Lot 1 was fed turnips just before milking, lot 2 was fed turnips after milking, and lot 3 received no turnips but was confined and milked in a stable in which the odor of turnips fed to fattening steers was very strong. During the first week lots 1 and 2 were fed 1 peck of turnips per cow daily and during the second week ½ bu. of turnips. The butter during these two weeks was scored as first-class.

During the third week, when the amount of turnips was increased to 3 pecks per day, "the taint was scarcely perceptible upon the milk, although the butter from lot 1 (turnips fed before milking) showed a slight flavor of turnips."

The fourth week 1 bu. of turnips per cow was fed daily. This week there was a decided flavor of turnips in the milk of both lots. At the commencement of the ripening process the cream from lot 1 was heated to 65° and 20 per cent of starter added, and that from lot 2 was heated to 75° and allowed to develop its own acid for 24 hours. "Lot 2 was scored low on account of the turnipy flavor, while lot 1 (turnips fed before milking) showed no turnipy flavor, indicating that the 20 per cent of starter added to the cream had overcome the turnipy flavor." The butter from lot 3 maintained its good quality during the 4 weeks, notwithstanding the strong odor of turnips in the stable.

During the fifth week all 6 of the cows were given all the turnips they would eat. The mixed cream was divided into three equal parts, all of which gave a strong odor of turnips. The first lot was heated to 75° and allowed to ripen naturally, the second lot was heated to 65° and 20 per cent of starter added, and the third lot was pasteurized and 20 per cent of starter added. "The butter from the first lot was very strong with the flavor of turnips. Lot 2 was not so bad as lot 1, while lot 3 (pasteurized) showed no turnip flavor at all. This indicates that pasteurizing and adding a starter will overcome the turnipy flavors in milk and butter."

The experiment was repeated April 6–27, the herd in milk at that time being divided into two lots, one fed turnips before milking and the other after milking. The amount of turnips was gradually increased until the cows were getting nearly 1 bu. per day.

The scoring of the butter made by the two lots and also from cream which received different treatment is given in the following table:

Quality of butter made when turnips were fed.

	Average score in flavor. (Max. 45.)			Average score in grain. (Max. 25.)			Average total. (Max. 100.)		
	First time.	Second time.	Average.	First time.	Second time.	Average.	First time.	Second time.	Average.
Turnips fed before milking	39	37	38	23	23	23	90.6	89.5	90
Turnips fed after milking	37.8	35.8	36.8	22.2	22.6	22.4	88.4	87.2	87.8
Turnipy cream pasteurized	40.75	40.0	40.37	23.2	23.0	23.1	93.7	92.0	92.8
Turnipy cream not pasteurized, but a starter added	40.00	38.0	39.00	23.3	23.0	23.1	91.6	90.0	90.8
Turnipy cream allowed to ripen of itself	36.0	33.0	34.5	21.6	23.0	22.3	86.0	85.0	85.5

"It will be noticed that pasteurization and the use of a starter improved the flavor very much."

Effect of period of lactation on creaming of milk and quality of butter (p. 64).—The cows in the herd were divided into three lots according to the period of lactation. The average percentage of fat in the skim milk was 0.26 for the fresh milkers, 0.5 for those milked from 3 to 6 months, and 0.51 for those milked over 6 months. The time required for churning increased with the stage of lactation. The scoring of the butter on a basis of 100 was 93 for the fresh milkers, 92.2 for those milked 3 to 6 months, and 90.7 for those milked over 6 months, the difference being chiefly in the flavor.

Effect of straining milk through broken ice before setting (p. 64).—In June and July 12 trials were made of straining milk through broken ice and then setting it in a creamer in ice water as compared with adding 20 per cent of cold water to the cream, and of setting in the ordinary way.

"It was no advantage to strain the milk through ice before setting, nor yet to add cold water to the milk. This accords with previous experiments where both hot and cold water were added before setting."

Milking machine compared with hand milking for quality of butter (pp. 64, 65).—On certain days about half the cows were milked with the Thistle milking machine and the other half by hand, butter being made from the milk of both lots. The scoring of the butter at 2 different dates is given.

"There was not so very much difference in the quality of butter when first made, but the machine butter spoiled, or went off in flavor, much more quickly." (See also p. 290.)

Pasteurizing milk for butter making (pp. 65, 66).—Several trials were made in October, in which a vat of milk was heated to an average of 97° F., after which one-half of it was separated at once and the other half heated to an average of 158° F. and then separated.

"It was found that the cream was richer from the milk heated to 158°, and the feed had to be increased in order to prevent the cream outlet from clogging. The extra feeding did not increase the loss of fat in skim milk. All our experience goes to show that the capacity of a separator is increased and that it will skim closer by heating the milk to 100° or over before skimming.

"In churning the cream from the two temperatures for heating it was found that the cream from pasteurized milk churned in a little less time (average 3 minutes) and with less loss of fat in the buttermilk—0.13 per cent, as compared with 0.19 in the buttermilk from unpasteurized milk. . . .

"The quality of the butter is better where pasteurization is practiced. . . . If the cream is properly cooled for a sufficient length of time before churning, the grain of the butter will be all right."

Pasteurized cream (p. 66).—Twenty trials were made in making butter from pasteurized cream as compared with cream not pasteurized. The scoring of the butter showed very little difference, although the butter from pasteurized cream kept slightly better.

Moisture in butter (p. 66).—The average of 48 samples of butter from the dairy department was found to be 11.034 per cent of water. The average water content of 14 samples, selected at random, was 11.297 per cent. Butter treated in a centrifugal butter dryer averaged 9.402 per cent of water, while the same butter handled in the ordinary way contained 10.125 per cent.

Temperature for ripening cream (pp. 66. 67).—Twenty-one trials were made, in which one lot of cream was ripened at an average temperature of 73° F., while the other lot was ripened at 60° F. It required 37 minutes to churn the former and 33 minutes to churn the latter. The percentage of fat in the buttermilk averaged 0.15 in the former case and 0.165 in the latter. The scoring of the butter gave no conclusive indications.

Different percentages of starter used to ripen cream (p. 67).—Thirteen trials, in which from 3 to 10 per cent of starter was added to one lot and about 11 per cent to the other, showed very little difference in the average results for the two lots, either in the loss of fat in the buttermilk or the quality of the butter.

Effect of washing butter (p. 68).—The results are given of 18 trials, in which the churning was divided into three parts, one part being unwashed, another washed once, and the third washed twice. The scoring of the butter showed less difference in favor of washing than last year (E. S. R., 9, p. 486).

Quality of butter made with centrifugal dryer (p. 68).—Half of the butter from the churning was put into the centrifugal dryer, which was revolved until no more moisture came from the butter, when it was removed, salted, and worked as usual. The other half of the churning was salted and worked in the ordinary way. As shown by the scoring of the butter, the quality "was practically the same for both methods."

Sweet and dent corn for milch cows, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 83, 84*).—An experiment was made

with 4 cows to compare the value of green sweet and dent corn for the production of milk. Previous to the commencement of the experiment the cows were on clover pasture and received in addition a pound of a mixture of bran and oil meal, 1:1, per day.

"During the first 10 days of the experiment the cows were fed green corn alone, cows 1 and 2 receiving sweet corn and cows 3 and 4 dent corn. At the end of 10 days 4 lbs. of meal were fed to each cow per day and the meal ration continued throughout the remainder of the experiment, or a period of 11 days. The meal ration consisted of equal parts by weight of barley, shorts, and oil meal. The variety of sweet corn used was Evergreen Sweet and the dent corn was Mammoth Cuban. . . . The cows did not eat the dent corn so readily as the sweet, and for a time wasted a considerable quantity of it, the waste becoming less as time went on."

The amount of green corn fed, eaten, and wasted, and the yield of milk during each period and for the 6 days immediately preceding and following the test are tabulated. The author states that "when fed corn alone the dent-corn group suffered a greater shrinkage in milk yield than the sweet-corn group;" that "when meal was added to the ration both groups increased in milk yield, but the sweet-corn group increased slightly more than the dent-corn group;" and that "when returned to pasture both cows of the sweet-corn group decreased in milk yield, while both cows of the dent-corn group slightly increased in milk yield." The superiority of the sweet corn is thought to be due to its greater palatability, "since the cows on sweet corn consumed more corn per hundred pounds of live weight than those on dent corn."

"There is one more important consideration. The sweet corn yielded at the rate of 29,280 lbs. of green fodder per acre, while the dent corn yielded at the rate of 36,376 lbs. per acre. . . . This greater yield of dent corn more than compensates for what is lost when compared with sweet corn for milk production, and therefore this experiment would indicate that the dent corn proved more economical than the sweet."

Machine-drawn milk vs. hand-drawn milk—some bacteriological considerations, F. C. HARRISON (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 128–132, figs. 2*).—A bacteriological study was made of the milk drawn with the Thistle milking machine and of that milked by hand. The investigations were made each month from April to August, inclusive.

"The average number of germs per cubic centimeter in the morning's milk from the machine for 16 weeks was 111,595, while the average in the hand milk for 14 weeks was 10,619—a result largely in favor of the hand milk. The average for the evening's machine milk was 165,033, and for the hand milk, 12,890—a result almost as much in favor of the hand milk. . . .

"A considerable variety was found in the machine milk, over 25 species being separated by the usual bacteriological methods, and all grown in pure culture in sterilized milk. . . .

"The germs in the hand milk were, generally speaking, of the same kinds as were found in the machine milk, but in the machine milk the putrefactive species (those that liquefy gelatin) were very much more numerous and varied."

The large number of bacteria found in the milk drawn with a machine is attributed to the following causes:

"(1) Germs on the hairy portion of the udder, drawn into the pail by the pulsation of the teat cups, etc.

"(2) Inability to cleanse thoroughly the cups and rubber connections.

"(3) The occasional falling of cups upon the stable floor, and constant contamination from material full of germ life.

"The infection under 1 and 3 may, we think, be largely prevented by due care on the part of milkers; and it is possible that the makers of the machine will devise some means of overcoming the difficulty about cleaning and disinfecting the udder cups and tubes."

Effect of the germs isolated from machine milk on the flavor and other qualities of butter, F. C. HARRISON and M. N. ROSS (*Ontario Agr. Col. and Expt. Farm. Rpt. 1897, pp. 133–140*).—Cultures of the germs isolated from milk drawn with the Thistle milking machine were used in preparing starters for ripening the cream, and butter was made from this cream in small lots. The data for these experiments, including a description of the cream before churning and the general quality and scoring of the butter, are tabulated, together with descriptions of the various species. In a few cases the butter was rated as fair, but in most cases it was off flavor and did not keep well.

"These experiments have shown that the number of undesirable germs in the 'machine' milk far exceeds that of those which are desirable. . . .

"Briefly, the germs isolated from the machine milk were 16 per cent more injurious than those isolated by Conn (his conditions being taken as normal.)

"The only practicable method of overcoming these bad effects is by thorough pasteurization of the cream and the addition of a good starter, produced from pasteurized milk to which has been added either good buttermilk from an excellent flavored butter, or, failing this, a culture obtained from some recognized source and which is known to be good."

Experiments in cheese making, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 41–59*).—Many of these experiments are in continuation of work reported the previous year (E. S. R., 9, p. 481).

Relation of fat in milk to quantity and quality of cheese (pp. 41–49).—During the year 27 experiments were made in each of which the milk was divided into different lots according to its fat content. The data for the experiments are given in detail and the averages of these data are summarized below:

Yield and quality of cheese from richer and poorer milk.

Group.	Fat content of milk.		Milk required to make 1 lb. of cheese.	Cheese produced from 1 lb. of fat in milk.	Fat content of whey.	Quality of the cheese.				
	Range.	Average.				Flavor (max. 35).	Closeness (max. 20).	Even color (max. 15).	Texture (max. 20).	Average total score (max. 90).
	Per cent.	*Per ct.*	*Lbs.*	*Lbs.*	*Per ct.*					
1	Below 3	2.88	11.529	3.01	0.225	28.33	18.16	14.16	16.83	77.48
2	3.00 to 3.50	3.26	10.968	2.79	.247	28.43	17.93	13.70	17.00	77.06
3	3.55 to 4.00	3.81	10.013	2.62	3.29	29.81	18.25	13.56	17.25	78.87
4	4.05 to 4.50	4.23	9.677	2.44	3.25	29.75	18.00	13.00	17.25	78.00
			10.512	2.70						

The following conclusions were reached:

"(1) The yield of cheese per 100 lbs. of milk increased when the percentage of fat increased, but it did not increase in exactly the same proportion.

"(2) The yield of cheese per pound of fat in the milk decreased as the percentage of fat increased.

"(3) The yield of cheese is fairly proportionate to the fat and casein in the milk. The casein may be represented by the figure 2 added to the percentage of fat in the milk.

"(4) The highest average score of cheese made was in the group where the milk ranged from 3.55 to 4 per cent of fat.

"(5) The [rich milk] cheese lost 3.1 per cent in weight while curing; the [medium and poor milk] cheese lost 3.3 per cent.

"(6) The loss of fat in whey, drippings, and pressings was greater from the rich milk. This is especially marked in the drippings after salting, which include the grease pressed out of the cheese while in the hoops. The loss of fat at this stage is nearly double that from medium and poor milk.

"(7) In those experiments where the percentage of casein was determined it showed a greater average loss of casein at each stage of the making from the [rich] milk as compared with the [medium and poor] milk.

"(8) We recommend the percentage of fat + 2 system for distributing proceeds among patrons of cheese factories."

Rapid curing cheese vs. slow curing cheese (pp. 49, 50).—During May and June 30 trials were made to compare the effect of using an extra quantity of rennet and less salt with the usual amounts of these. The general qualities of the cheese and its keeping quality were observed.

"In the spring of the year, when it is usually the best policy to make cheese which will cure or ripen quickly, we advise the use of 4 to 5 oz. of rennet per 1,000 lbs. of milk, or sufficient to cause coagulation in 20 to 25 minutes. Less salt—say 2 lbs. per 100 lbs. of curd or per 1,000 lbs. milk—may also be used. . . .

"Where the extra amount of rennet and the small quantity of salt were used the cheese ripened and went off in flavor more quickly."

Stirring curds (p. 50).—To test the suggestion that "curds need not be stirred so much if an extra quantity of salt were applied," 7 trials were made during September and October. In each trial both lots of milk were treated exactly the same, except that one lot was not stirred after dipping but an extra quantity of salt was added to the curd.

"(1) By not stirring the curd there was an extra pound of cured cheese made from 600 lbs. of milk.

"(2) The quality of the two cheeses was much alike.

"(3) With a small curd the extra salt applied seemed to have the same effect as hand stirring of the curd."

Aeration of milk for cheese making (pp. 50, 51).—During July, August, and September, 15 experiments were made, in each of which a vat of aerated and another of unaerated milk was used.

"While the average of the results did not indicate much difference in the yield or quality of the cheese, nor did aerating the milk prevent the formation of gas, yet the gas was easier got rid of from the aerated milk curds; and in case of badly flavored milk, the aeration made an improvement in the yield and quality of the cheese.

"We shall need to make further experim nts before making any very definite statements about the effects of aeration on milk for cheese making. In the meantime we advise aeration in or with a pure atmosphere."

Pasteurizing milk for cheese making (pp. 51, 52).—Cheese was made from pasteurized milk with and without a starter, the milk being made up into cheese the same day as pasteurized in some cases and in others the following day.

"The heating of the milk to 160° changes the character of the milk in such a way that it does not work at all like an ordinary Cheddar curd. The cheese made from pasteurized milk resembles Stilton cheese in many respects; in fact our experiments point to a new and successful method of making a famous Stilton cheese.

"The cheese made from heated milk to which a starter was added more nearly resembled an ordinary Cheddar. The experiments so far made would lead us to doubt the value of pasteurization for Cheddar cheese making. In every case where the milk was kept over until the following day the curds were very gassy."

Ripening milk before adding rennet (p. 52).—The results are given of 8 trials made during May and June. The rennet test varied from 13 to 31 seconds.

"The general rule seems to be that a difference of one second in the rennet test will make a difference of about two minutes in the time required for coagulation, although there are some marked exceptions to this rule."

Effect of different quantities of rennet (pp. 54, 55).—Several experiments were made in which milk ripened to a rennet test of about 22 seconds was treated with varying quantities of rennet ranging from 1 oz. to 8 oz. per 1,000 lbs. of milk.

"(1) Where less than 3 oz. of rennet per 1,000 lbs. of milk was used there was an extra loss of fat in the whey and less cheese made. The extra quantity of rennet, above 3½ oz., made an extra yield of cheese.

"(2) The highest scoring cheese was made using 2½ and 3 oz. of rennet per 1,000 lbs. milk.

"(3) The time required for coagulation decreases with an increased quantity of rennet used in the milk."

Effect of dipping at different stages of acid (pp. 55, 56).—A number of trials on this subject were made during June and July with the following results:

"(1) The time from setting to salting was about the same, irrespective of the time which the curds were allowed to remain in the whey.

"(2) The yield of cheese was greater by dipping at about ⅛ in. of acid, or 0.2 per cent, than where the curds were allowed to remain until over ¼ in. of acid showed on the hot iron.

"(3) The percentage of fat in the drippings (whey from milling until the cheese are removed from the press) was higher in all cases where the curd remained in the whey for a long time.

"(4) The quality of the cheese was better in nearly every case from dipping at ⅛ to ¼ in. of acid as shown on the hot iron."

Milling the curd (pp. 56, 57).—Nine experiments were made in each of which the curd was divided into 2 parts before milling, one-half being milled at about 1 hour and 40 minutes after dipping, when the hot iron indicated about 1 in. of acid, and the other half at periods ranging from 1 to 3 hours after dipping.

"(1) About 1¼ in. was the longest 'string' which could be got on the hot iron. After this the 'strings' went back.

"(2) Whether milled at 1½ hours after dipping, or longer, the curds were ready to salt at about the same time.

"(3) Allowing the curds to remain for 2½ to 3 hours after dipping, and before milling, causes a greater waste of butter fat than milling earlier.

"(4) There did not appear to be so very much difference in the quality of cheese produced from the two methods.

"(5) We recommend milling about 1½ hours after dipping, or when the curd becomes meaty and shows ¾ to 1 in. of acid on the hot iron."

Salting curds 1 hour sooner than usual (pp. 57, 58).—During April, May, June, September, and October 15 experiments were made, one-half of the curd being salted about 1 hour sooner than the other half, which was allowed to develop the "velvety" feel.

"(1) The yield of cheese per 100 lbs. of milk was slightly greater by salting one hour before the curds became 'velvety.'

"(2) The loss of fat in pressings and drippings was slightly greater by allowing the curds to 'mellow down' before salting.

"(3) There was not much difference in the quality of the cheese whether salted early or late, what difference there was being in favor of mellowing the curds before salting."

Temperature of curds at time of putting to press (pp. 58, 59).—In 9 experiments the curd was divided, the two parts being put to press at different temperatures.

"The range of temperature was from 62° to 95° at the time of hooping. The highest scoring cheese was made from a curd put to press at 93°. Last year there was more openness in the cheese put to press at a high temperature. This difference did not seem to be so marked this year.

"So long as the press room is kept moderately warm there does not seem to be much difference in the quality of the cheese whether put to press at 65 or 95°, or at any temperature between these two points."

Bad flavor in cheese caused by undesirable bacteria in water used in factory, F. C. HARRISON (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 141–144*).—The case of a factory where cheese of a bad flavor was being made was investigated. The cheese maker was said to be a good maker and the factory in first-class condition. A bacteriological examination of the water showed a very large number of germs present, from which 5 different species were isolated. The germs isolated from the water and the cheese were compared, and 2 of the species found in the water were discovered to be identical with 2 found in the cheese, but 1 was in such small numbers that it was disregarded. The biological characteristics of the other germ are described, together with an experiment in which cheese was made from pasteurized milk inoculated with a culture of this germ. This cheese proved to be of bad flavor, and the germ previously found in the cheese and water was isolated from it. The cheese maker was advised to stop using the water, and the report soon came that the cheese was all right.

Miscellaneous dairy notes, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 71–80*).—These include a reprint of newspaper bulletins on fodder and spring cheese, the curing of cheese, and the winter creamery; and notes on milk tests at fairs, square cheese, the milking machine, the air process in butter making, working

over old butter, tests of cows, etc. Some experimental square cheeses sent to London brought satisfactory prices, but "the shape was not suitable for the London trade." With regard to the Thistle milking machine it is stated that "it milked the cows clean, and after a few times use nearly all of the cows seemed to enjoy being milked by it as well as by hand. The greatest trouble we had was with the flavor of the milk. The pipes through which the air is forced by the machine become very foul from the milk drawn into them whenever a cup drops from a teat. I believe that this difficulty has been remedied."

A trial of working over stale butter resulted in very little improvement.

General system of feeding the dairy herd, W. P. WHEELER (*New York State Sta. Rpt. 1896, pp. 639–641*).—General remarks on the character of the rations fed to the dairy herd at different times during the year.

Concerning Russian dairy cattle. Observations and experiments on the productiveness of a dairy herd during a period of six years (1889–1894) at the Edium school of dairying, N. V. VERESHCHAGIN and A. A. POPOV (*Moscow, 1896, pp. 28–179, dgms. 3; abs. in Selsk. Khoz. i Lyesov., 184 (1897), Mar., pp. 702, 703*).

Dairy stock, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 69, 70*).—This is a record of the herd for the year, showing the yield and cost of milk, butter, and cheese for each cow.

Green rye and alfalfa for milch cows, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, p. 85*).—Rye and alfalfa were compared as soiling crops for milch cows. No details of the experiment are given. The general conclusions, summarized by the author, are as follows:

"The rye, which was a medium crop, yielded at the rate of 12,375 lbs. of green fodder per acre and the alfalfa yielded a first cutting at the rate of 15,300 lbs. of green fodder per acre. The alfalfa was eaten rather more readily by the cows than the rye. The milk yield was slightly in favor of the alfalfa. When scored by an expert the rye butter scored 35 points for flavor and the alfalfa butter 40 points for flavor, out of a possible score of 45 points. The plat of alfalfa furnished 2 subsequent crops, which made the total yield from the alfalfa plat more than double that stated above, whereas the rye made but an indifferent second growth."

Oats and peas and peas and tares for milch cows, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 84, 85*).—A comparison was made of green oats and peas and oats and tares for milch cows. The seed was mixed in the proportion of 2 bu. of oats to 1 of peas and 2 bu. of oats to 1 of tares. Two cows were fed on each ration. Only the general conclusions are given. Both fodders were eaten readily and neither could be said to excel the other as a milk producer.

"The oats and peas yielded at the rate of 14,760 lbs. of green fodder per acre and the oats and tares 14,688 lbs. per acre."

Effect of drought upon milk production, L. L. VAN SLYKE (*New York State Sta. Rpt. 1896, pp. 37–65*).—This is the same as Bulletin 105 of the station (E. S. R., 8, p. 825), with detailed tabulated data not given in the bulletin.

Milk fat and cheese yield, L. L. VAN SLYKE (*New York State Sta. Rpt. 1896, pp. 66–106*).—This is the same as Bulletin 110 of the station (E. S. R., 9, p. 181), with some detailed tabulated data not given in the bulletin.

Analyses of butter, A. L. WINTON, A. W. OGDEN, and W. L. MITCHELL (*Connecticut State Sta. Rpt. 1897, pp. 322, 323*).—Analyses are reported of butter from England (Dorsetshire), Denmark, Normandy, Australia, Brittany, and Ireland, and from the Vernon Creamery, Connecticut. The butter from Normandy, Australia, Brittany, and Ireland "gave a decided reaction for boric acid, probably present in the form of borax." The samples were scored on the basis of flavor, grain, color, salt, and package.

Machine-drawn milk for cheese making, F. C. HARRISON (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, p. 141*).—Two small cheeses were made from milk drawn with the Thistle milking machine. "The curd was gassy, there was great loss of fat at salting, and the curd had a very bad flavor. [A month later] the flavor was scored 20 and 26, respectively, out of 35."

VETERINARY SCIENCE AND PRACTICE.

Report of the veterinary department, A. W. BITTING (*Indiana Sta. Rpt. 1897, pp. 11–50*).—It is stated that studies have been made along the lines of the water supply for the live stock in the State; hog cholera; tuberculosis; the treatment of contagious abortion among cattle; the fecundity of swine (p. 280); the relative frequency of the occurrence and distribution of diseases of stock in the State; sheep dips; and the embryology, anatomy, and physiology of the mammary gland.

On the subject of tuberculosis it is noted that some 2,000 cattle have been tested since the station took up the work. The experiments with sheep dips resulted in showing that chloro-naphtholeum, zenno-leum, Potter's Perfection Dip, and Daytholeum are effective in solutions of 1 per cent. In the study of diseases 2,975 cases of lameness, 587 of fistulæ, 28 of bursatte, 29 of cornstalk disease, 59 of cerebro-spinal meningitis, 528 of parturient apoplexy, 268 of periodic ophthalmia, 250 of pleurisy, 543 of pneumonia, 489 of laminitis, 217 of enteritis, 266 of gastritis, 2,042 of colic, 759 of azoturia, 502 of canine distemper, 67 of specific ophthalmia of cattle, 30 of sporadic aphthæ, 218 of tetanus, 67 of tuberculosis, 2,608 of influenza, 12 of rabies, 24 of glanders, 42 of abortion in cows, 15 of abortion in mares, 8 of anthrax, and 120 of actinomycosis were found. The table given shows little difference in the number of cases occurring in the different months of the year, with the exception of azoturia, which was most frequent in January, February, and March. The loss from hog cholera during 1897 was only about 70 per cent as great as in 1896. The townships bordering upon the rivers lost 50 to 70 per cent more than those lying farther back.

Report of the veterinary science section, M. STALKER and W. B. NILES (*Iowa Sta. Rpt. 1896–97, pp. 131–144*).—After mentioning the general plan of organization of work it is stated that Texas fever has, through legislation, ceased to be feared; that glanders and farcy among horses have been practically exterminated in the State, although some dozen years ago about half the counties of the State were affected; and that tuberculin has been successfully used in diagnosing tuberculosis and with systematic application of the best knowledge of the subject there is promise of favorable final results. Swine plague and hog cholera, cornstalk disease, and pseudo-rabies are discussed. Appended are articles on hog cholera and swine plague and on bovine tuberculosis.

Animal diseases, A. T. PETERS (*Nebraska Sta. Rpt. 1897, pp 13–17*).—The author makes brief notes on the occurrence of actinomycosis, which has been reported in only a very few instances; anthrax, which has appeared in Polk County; black leg; cornstalk disease; keratitis; glanders, which has been reported from 16 counties; rabies, which in Otoe County affected 10 hogs, 2 cows, a mule, and a horse; tuberculosis, and hog cholera. The cornstalk disease seems to have affected horses to a greater extent than in former years. It is noted that it may be prevented to a certain extent by feeding something else than cornstalks before the animals are turned into the field. Keratitis has appeared among cattle in certain localities, affecting

animals mostly while in pasture. The disease is described by stockmen as follows: "The animal will be seen to be uneasy, and if the left eye is affected will hold the head down and try to drive away with the left foot the object that seems to it to be on or covering the eye."

Tuberculin, F. C. HARRISON (*Ontario Agr. Col. and Expt. Farm Rpt. 1897, pp. 144–149, figs. 3*).—Tuberculin for official herd testing in Ontario is now manufactured and sent out by the college. Directions are given for making the test, and the summarized results secured in the testing of 502 animals of different breeds during 1897 are tabulated. The danger of using milk from tuberculous cows is discussed and notes given on three clinical examinations of guinea pigs inoculated with milk from tuberculous cows. The guinea pigs either died or were killed in from 8 to 10 weeks after inoculation and in every instance were found tuberculous.

On the means of protecting domestic animals from infectious diseases, R. LETZ (*Selsk. Khoz. i Lyesov., 186 (1897), Sept., pp. 613–634*).

STATISTICS—MISCELLANEOUS.

Reports of director and treasurer of California Station, 1895–1897 (*California Sta. Rpt. 1895–1897, pp. XVI + 329, 346, 347, 363, 364, 427–455*).—Treasurer's report for the fiscal years ending June 30, 1896 and 1897; directions for sending samples to the station for examination; organization list; list of donations to the station; exchange list, and reports on the work at the Southern Coast Range, San Joaquin Valley, and Southern California Culture Substations, management, local problems, etc.

Twenty-first Annual Report of Connecticut State Station, 1897 (*Connecticut State Sta. Rpt. 1897, pp. XV*).—Notices relative to the availability of the bulletins and reports of the station; list of the officers and staff for 1897; announcements as to the nature of work undertaken for outside parties; report of the secretary of the board of control of the station on the work of the year, and a report on the changes in the experiment station grounds necessitated by the laying out of certain new streets.

Tenth Annual Report of Indiana Station, 1897 (*Indiana Sta. Rpt. 1897, pp. 1–15, 60–69*).—Report by the director on the experimental work carried on by the different departments during the year, improvements, pamphlet and newspaper bulletins published, mailing list, and an inventory of station live stock. The appendix to the report contains lists of acknowledgments and exchanges and a financial statement for the fiscal year ending June 30, 1897.

Reports of director and treasurer of Iowa Station, 1896–97 (*Iowa Sta. Rpt. 1896–97, pp. 102–105, 145, 146*).—Brief notes on the work of the station during these two years, with a general review of the bulletins published (32–35), and a financial statement for the fiscal years ending June 30, 1896 and 1897.

Eleventh Annual Report of Nebraska Station, 1897 (*Nebraska Sta. Rpt. 1897, pp. 40*).—A report by the director on the station staff, improvements during the year, lines of experiments carried on, cooperative work, farmers' institutes, publications of the station in 1897, mailing list, etc.; and by the agriculturist, veterinarian, botanist, chemist, entomologist, geologist, horticulturist, and meteorologist on the work of their respective departments during the year, some of the details of which are noted elsewhere; and a financial statement for the fiscal year ending June 30, 1898.

Ninth Annual Report of Nevada Station, 1896 (*Nevada Sta. Rpt. 1896, pp. 28*).—Contains the organization list of the station; brief reports by the director and heads of departments on the work of the year, and a financial statement for the fiscal year ending June 30, 1896. In addition to other matter the report of the agriculturist contains brief suggestions on the culture of corn under Nevada conditions. A poisonous plant (*Zygadenus paniculatus*), which has caused the death of several range cattle, is briefly noted.

Reports of director and treasurer of New York State Station, 1896 (*New York State Sta. Rpt. 1896, pp. VIII 1–34, 688–694, 719–752, pls. 5*).—Treasurer's report for the fiscal year ending September 30, 1896; station organization list; reprint of the report of the director, published as Bulletin 115 of the station (E. S. R., 9, p. 197), and lists of acknowledgments and exchanges.

The world's production of cereals, L. GRANDEAU (*Jour. Agr. Prat., 2 (1898), No. 28, pp. 45–49*).—Statistics on the production of wheat, rye, oats, barley, and corn.

The agriculture of Finland, its development and present state (*Rpt. Imperial Senate of Finland. Helsingfors, 1896, pp. 389, figs. 11, dgms. 6, maps 5; abs. in Selsk. Khoz. i Lyesov., 184 (1897), Feb., pp. 470–472*).—Describes chiefly the organization and activity of the Department of Agriculture of Finland.

History of the Imperial Moscow Society of Agriculture during the past 75 years (December 20, 1820–December 20, 1895), A. P. PERYEPYOLKIN (*Moscow, 1896, pp. 165 + 239 + 72, figs. 5; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Dec., p. 671*).

Sketches from the history of agriculture in southern Russia, A. GROTTO-HYEPIKOVSKI (*Selsk. Khoz. i Lyesov., 185 (1897), Apr., pp. 39–94*).

Index of agricultural scientific institutions based on information up to January 1, 1897 (*Rpt. Min. Agr. and Govt. Estates, Div. Rural Econ. and Agr. Stat. St. Petersburg, 1897, pp. XXIV + 194; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Oct., p. 231*).—The total number of scientific institutions under the jurisdiction of the Department of Agriculture is 108, with 5,000 students. Of these 2 are higher schools, 11 secondary, and 95 lower.—P. FIREMAN.

The year 1896 from the standpoint of agriculture according to reports from farmers, VI (*Rpt. Min. Agr. and Govt. Estates, Div. Rural Econ. and Agr. Stat. St. Petersburg, 1897, pp. LVIII + 94; abs. in Selsk. Khoz. i Lyesov., 185 (1897), May, p. 486*).—The report contains a survey of the prices of agricultural products, live stock, and the products of stock raising, and also a chapter on the influence on prices of the crop of 1896.—P. FIREMAN.

Index to authors, with titles of their publications, appearing in the documents of the United States Department of Agriculture, 1841–1897, G. F. THOMPSON and G. W. HILL (*U. S. Dept. Agr., Division of Publications Bul. 4, pp. 303*).

The work of the college of agriculture and experiment stations, E. W. HILGARD (*California Sta. Rpt. 1895–1897, pp. 3–19*).—A revised reprint of Bulletin 111 of the station (E. S. R., 8, p. 735).

The Minnesota plan for agricultural teaching, R. H. LOUGHRIDGE (*California Sta. Rpt. 1895–1897, pp. 19–22*).—A discussion of the desirable features of the School of Agriculture of the University of Minnesota and on the practical results and success of the school.

Farmers' institutes in California, E. J. WICKSON (*California Sta. Rpt. 1895–1897, pp. 23, 24*).—A brief report on the institute work of 1896. Meetings were held in 52 localities during the year.

Changes in the rates of charges for railway and other transportation services, J. HYDE and H. T. NEWCOMB (*U. S. Dept. Agr., Division of Statistics Bul. 15, misc. ser., pp. 80*).—A comprehensive historical report extending over a period of 50 years, and dealing with the charges on railways, canals, and waterways for the transportation of agricultural products, etc., to the principal markets and seaports in the United States, and containing certain tabular data relative to passenger rates.

NOTES.

COLORADO STATION.—Elmer D. Ball has succeeded Emma Gillette as assistant entomologist, and Carl H. Potter has succeeded Jacob H. Cowen as assistant horticulturist.

IDAHO COLLEGE AND STATION.—J. P. Blanton has been appointed president of the University of Idaho and director of the Station, *vice* F. B. Gault. H. T. French, formerly of the Oregon Station, has accepted the position of professor of agriculture in the college and agriculturist of the station. Thorn Smith, formerly first assistant chemist of the Michigan Station, has accepted a similar position with the Idaho Station. Prof. A. S. Miller has been added to the station staff as geologist. A commodious greenhouse and horticultural building has been erected. The chair of horticulture has been created and F. A. Huntley appointed to the professorship. Ashby Turner has resigned as a member of the governing board and James H. Hawley, of Boise, has been appointed in his place.

ILLINOIS STATION.—The station has recently begun publishing abstracts of its more technical bulletins. The full bulletin will be issued in a limited edition and sent only to scientific readers upon request, while the abstract will be sent to all names upon the regular mailing list.

INDIANA STATION.—A new stave silo 28 ft. high and 12 ft. in diameter has recently been erected. A. H. Bryan, a graduate of Purdue University in the class of 1898, has been appointed assistant chemist, *vice* J. M. Barrett, resigned.

IOWA COLLEGE.—Farmers' excursions have been inaugurated at the college. The first excursion was held August 17, and the occasion was a marked success in every particular. About 6,000 people were in attendance. It is believed these excursions will result in more cordial and friendly relations between the college and the people of the State.

KANSAS STATION.—R. W. Clothier has been appointed assistant chemist of the station. The studies on soil moisture have been continued and additional experiments commenced to test the effect of various fertilizers upon moisture conservation. Digestion experiments have been made with alfalfa at three stages of growth and with prairie hay. The veterinary department is distributing blackleg vaccine to the stock owners of the State. During the first half of October, 3,500 double doses were sent out. Experiments in protective inoculation for swine plague are in progress. The virus used is that prepared by H. J. Detmers. A press bulletin on the sand plum, one of the most valuable native fruits of Kansas, has been distributed.

MAINE STATION.—Otis Meader has been added to the governing board. Miss Mary Hutchinson has been appointed clerk, *vice* Mrs. J. Hamlin Waite.

NEBRASKA STATION.—The board of regents has authorized the making of analyses of 10,000 mother beets grown upon the experimental plat at Ames, Nebraska. C. H. Elmendorf, of the station, served as acting superintendent of the live-stock department of the Omaha Exposition, and T. L. Lyon was in charge of the dairy tests.

NEW HAMPSHIRE COLLEGE AND STATION.—Charles W. Burkett, of the Ohio State University, has been elected associate professor of agriculture of the college and agriculturist of the station.

NORTH CAROLINA COLLEGE AND STATION.—Dr. Cooper Curtice has been appointed veterinarian and biologist in the college and station. F. E. Hege, poultry manager

of the station, has resigned. The work of this department will be carried on under the supervision of the director and the agriculturist. A. W. Blair has been appointed State chemist, and will have charge of the analyses for the fertilizer control and for the general public under the supervision of the director.

Oregon Station.—James Withycombe has been appointed assistant director and agriculturist of the station.

Pennsylvania Station.—W. S. Sweetser, assistant chemist, terminated his connection with the station October 1, 1898, to accept a position as assistant instructor in agriculture in Hampton Normal and Agricultural Institute. M. S. McDowell, A. M. Diehl, and Charles Beistle have been appointed assistant chemists of the station. At its annual meeting in June the board of trustees established two fellowships—one in dairy husbandry and one in agricultural chemistry. These fellowships were filled, after competitive examination, by the appointment of J. D. Huston and W. A. Hutchison, respectively, graduates in agriculture of the class of 1898. The purpose of the fellowships is to utilize the facilities for advanced work of a high grade in agriculture which are available in connection with the work of investigation carried on at the station. The "fellows" are to devote a portion of their time to the regular work of the experiment station and the remainder to advanced study and investigation. Arrangements have been made by which the United States Department of Agriculture and the station are to cooperate in the construction of a respiration calorimeter for experiments with domestic animals and the prosecution of scientific investigations into the principles of animal nutrition.

South Carolina College and Station.—G. E. Nesom has been appointed veterinarian, *vice* W. E. A. Wyman; B. F. Robertson has succeeded John Thompson as assistant chemist at the station; and Ernest Walker has been appointed assistant horticulturist and entomologist. Special experiments are being made on the effect of different forms of potash, including silicate, on several crops, especially on the starch content of roots and tubers and on the burning quality of tobacco. The injurious effect of the inoculation of the soil by certain legumes on the subsequent growth of other kinds of legumes is also being studied.

Vermont College and Station.—G. H. Perkins and J. L. Hills have been elected deans of the departments of natural history (including chemistry, physics, and biology) and of agriculture, respectively. L. R. Jones and F. A. Waugh have been granted a half year's leave of absence for special studies in botany and horticulture.

Wyoming Station.—A small potting house 18 by 16 ft. has been added to the greenhouse plant, and the dwelling house on the farm has been improved by certain additions. The farm equipment has been increased by the purchase of a Deering Ideal mower, a bone and grain mill, and a 4-horsepower portable gasoline engine. Much interest is manifested among the farmers in the forage crops being grown upon the station farm. Flat pea stands drought well and produces large crops, but so far stock will not eat it either in the green or dry state. It has not yet been offered to sheep. The success of alfalfa in this region is assured when planted with a press drill and otherwise properly handled. Another season the farmers will plant larger areas to it. Hairy vetch is also very promising, and sanfoin does exceedingly well.

Personal Mention.—Dr. F. Noll has become professor of botany at the Royal Agricultural Academy of Poppelsdorf, as the successor of Professor Körnicke, retired.

Dr. Oscar Loew, formerly connected with the College of Agriculture of the Imperial University of Japan, but later of Munich, has been appointed to a position in the Division of Vegetable Physiology and Pathology of this Department.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director*,

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers (including methods of analysis), Soils, and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
F. C. KENYON, PH. D.—Entomology and Veterinary Science.
R. A. EMERSON—Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 4.

The following statements regarding the labors of Dr. E. Lewis Sturtevant, one of the earlier agitators for experiment stations in this country and an active student and investigator of agricultural problems, are furnished by Prof. C. S. Plumb, who was for several years associated with him in his work at the New York State Experiment Station. For years Dr. Sturtevant was a prominent figure in movements for the benefit of agriculture, and devoted himself enthusiastically to the advancement of both the science and the art. During the later years of his life, when prevented by failing health from active participation in experiment station work, he continued his studies and investigations at his home and prepared for publication some of the material which he had gathered in the form of notes during the busier periods of his life. In this way the results of his extensive studies on the varieties of corn were brought together and arranged for publication as a bulletin of this office, now in press. In this extensive monograph the several hundreds of varieties have been described and systematized, the classification followed being the one previously published by Dr. Sturtevant. The synonymy has been much reduced, clearing up the confusion of varietal names of corn and placing the nomenclature on a sound scientific basis.

The recent death of Dr. E. Lewis Sturtevant, on July 30 last, marks the passing of one who has occupied a pioneer and important place in the history of agricultural research in America. Born in Boston in 1842, educated in the best schools of the East, and receiving degrees from Bowdoin College and the Harvard University Medical School, he was equipped with a training that enabled him to be of great service to his fellows.

After serving for a time in the Civil War, during which he was promoted to the captaincy of his company in the 24th Regiment of Maine Volunteers, sickness caused his retirement to civil life, and he took up the study of medicine at Harvard, where he graduated in 1866. Being of independent means, he returned to the home farm at South Framingham, Massachusetts, some 25 miles west of Boston, where he began the agricultural studies which continued during the rest of his life. Here, on "Waushakum Farm," the joint property of his brother and himself, he took up a study of dairying and the Ayrshire breed of cattle, bred

and improved a variety of yellow flint corn named after the farm, and otherwise engaged himself in agricultural problems. His milk investigations early in the seventies attracted considerable attention, and he lectured before prominent societies in 1873–74, discussing the physiology of milk, and bringing out striking differences in size of fat globules in milk of several breeds of cows, as found by him in microscopical examinations. The subjects of corn culture, farm fertility, and dairying attracted his chief attention, and he became widely known over New England and the Middle States as a prominent agricultural investigator and lecturer.

Dr. Sturtevant early recognized the importance of a more intelligent farming practice, which could be greatly promoted through the aid of boards of agriculture, experiment stations, and agricultural schools and colleges, and was a prominent leader in the agitation for the establishment of experiment stations. In an address before the Middlesex South Agricultural Society in 1872 he said: "Every agricultural society should be an experimental station. No matter how few or how many facts or discoveries it makes, each one should have the precision and form which would enable it to be used in connection with other facts derived from other sources. The common facts of the farm are comparatively unknown. What is a day's labor at any kind of work? What is the effect of various kinds of food? What is the comparative value of various feeds used on our farms? What is the usual yield of a good milch cow? These and other simple questions, which should have been determined long ago, still remain practically unanswered. The constants of agriculture are yet to be given."

In 1882 he was invited to become director of the New York State Experiment Station at Geneva, New York, just established, which position he held for 5 years, resigning in 1887. The duty devolved upon him of organizing the new institution, outlining the work, equipping laboratories, planning field and laboratory experiments, and establishing a working, coherent experiment station. This Dr. Sturtevant did on a more extensive plan than was attempted by any other American station in operation at that period. He proved himself a good organizer of work and an efficient manager of men. He gathered about him an excellent corps of workers, nearly all of whom have since been among the leading workers in the experiment stations of this country. He personally planned extensive field work with standard farm crops, and especially the cereals, devised feeding experiments with dairy cattle, and directed large experimental work in the vegetable garden.

The first six reports of the New York State Station, issued under his direction, contain much information on live agricultural problems, and show marked activity on the part of the station working force. When he resigned his place at Geneva, it was to go back to his home, to remain in retirement, for a number of years an invalid.

Dr. Sturtevant's influence on agriculture from the educational or

scientific standpoint was significant. His published writings number several hundred titles. He was the author of many addresses that were widely read. For several years he partly or entirely edited the Scientific Farmer. With his brother Joseph he was author of a book on the Ayrshire cow that contains much valuable information concerning this breed. He was one of the original founders of the Society for the Promotion of Agricultural Science, and took an active interest in its work up to his final illness. He made a special study of maize for over 20 years and was the best authority on the history and characteristics of this plant. He gave great attention to the edible plants, had collected the most complete pre-Linnean library in America, and was an authority on the history of garden vegetables. During the last 10 years of his life while in health he gave much time to the study of plant history and was a frequent contributor on this subject to the American Naturalist, the Botanical Gazette, and Torrey Botanical Club Bulletin.

Dr. Sturtevant was a man of great fertility of mind, active temperament, and enthusiasm for his work. He was constantly accumulating information relative to the problems he was dealing with. In his intercourse with others he was fond of analytical discussion, during which one might be sure of having numerous phases of the subject presented for consideration. To the attentive listener he was full of suggestive ideas, and made a deep impression for his originality of thought.

A National Society of Agriculture has been organized in Egypt, under the patronage of the Khedive, for the promotion of agricultural investigations on seeds, plants, fertilizers, domestic animals, beneficial and injurious insects and birds. The society will have its headquarters at Cairo and will publish a bi-monthly bulletin. It will endeavor to effect exchanges of publications with agricultural societies, experiment stations, and other agricultural organizations in different countries. It will also organize agricultural exhibitions and it is proposed to carry on six experimental farms under its auspices. A large number of the leading farmers of Egypt have been enrolled as members of this society. Its secretary is George P. Foaden, formerly professor of agriculture in the agricultural college at Ghizeh, maintained by the Egyptian Government.

OFFICIAL METHODS OF ANALYSIS OF FERTILIZERS AND FEEDING STUFFS ADOPTED BY THE BELGIAN STATE LABORATORIES AND THE AGRICULTURAL EXPERIMENT STATIONS OF HOLLAND.

The State laboratories of Belgium and the agricultural experiment stations of Holland have recently adopted uniform methods for the analysis of fertilizers and feeding stuffs. While the methods are, as a rule, very similar to the official methods in this country and in Germany, they differ somewhat in the details of execution. The following condensed account of the methods is taken from the bulletin of the Belgian Minister of Agriculture.[1]

ANALYSIS OF FERTILIZERS.

Ammoniacal nitrogen.—Ammoniacal nitrogen is determined by distilling 50 cc. of a solution prepared by dissolving 10 gm. of sulphate of ammonia in 1 liter of water with calcined magnesia, the ammonia being collected in 20 cc. of one-half normal sulphuric acid and the excess of acid titrated with alkali, preferably one-fourth normal barium hydrate.

Nitric nitrogen.—For the determination of nitric nitrogen two methods may be employed, the Schloesing-Grandeau and the Ulsch methods. In the first case, with nitrate of soda, 10 cc. of a solution containing 16.5 gm. of the nitrate per liter is used; with nitrate of potash the same amount of a solution containing 20 gm. of the nitrate per liter is used. The solution of nitrate is treated in a Schloesing apparatus with 50 cc. of a solution of ferrous chlorid saturated in the cold and an equal volume of concentrated hydrochloric acid, rinsing the funnel with dilute acid (1 to 1). The results obtained are compared with those obtained by the same treatment of 10 cc. of type solutions containing 33 gm. of pure nitrate of soda or 40 gm. of pure nitrate of potash per liter. The receiver for the gas is filled with cold distilled water recently boiled. Air is expelled from the apparatus by introducing a little nitrate.

The form of Ulsch method used (not applicable in the presence of ammoniacal salts) is as follows: To 25 cc. of a solution prepared by dissolving 10 gm. of the substance in 1 liter of water 5 gm. of iron reduced in hydrogen and 10 cc. of dilute sulphuric acid (1 volume of concentrated acid to 2 volumes of distilled water) are added in a $\frac{1}{2}$-liter flask, which is connected with a condenser. The solution is heated

[1] Bul. Min. Agr. [Belgium], 1898, No. 3, pp. 18.

until evolution of gas commences. The flame is then removed until the evolution subsides. Finally the flask is heated gently for about 5 minutes. One hundred cubic centimeters of distilled water is added and the ammonia distilled off in the presence of 3 gm. of calcined magnesia or of 30 cc. of a soda solution of 1.25 sp. gr.

Organic nitrogen.—Two methods of determining organic nitrogen are employed, the Kjeldahl and the modified Gunning methods. In the first 1 gm. of blood or horn, 1½ gm. of leather, wool, oil cake, or fish guano, and 2 gm. of ground bone is digested with 10 to 20 cc. of sulphuric acid of 66° Baumé, containing 10 per cent of phosphoric anhydrid and a drop of mercury (about 0.5 gm.) or from 0.5 to 1 gm. of mercury bioxid. The digestion is continued at least 1 hour after the solution has become colorless. After cooling the solution is nearly neutralized with potash solution (1 part of potash to 2 of water), and then 40 cc. of a solution containing 50 gm. of caustic soda and 20 gm. of sodium sulphid per liter is added. The operation is continued in the usual way.

In the modified Gunning method the same weights of material are used, the substance being digested in 20 cc. of 66° Baumé sulphuric acid with the addition of 1 gm. of mercury and 1 gm. of copper sulphate. When the substance has become charred 10 to 15 gm. of potassium sulphate in crystals is added and the mixture strongly heated. Digestion is complete in about half an hour. The operation is completed as in the Kjeldahl method.

With fertilizers containing a mixture of nitric and ammoniacal nitrogen 10 gm. is dissolved in 500 cc. of water and 25 or 50 cc. of the solution used for the different determinations, nitric nitrogen being determined by the Schloesing-Grandeau method, ammoniacal nitrogen by distillation with magnesia.

With fertilizers containing organic and ammoniacal nitrogen the total nitrogen is determined in 2 gm. by the Kjeldahl method, ammoniacal nitrogen in 5 gm. by distillation with magnesia.

With fertilizers containing organic and nitric nitrogen the total nitrogen is determined in 1 to 2 gm. by the Kjeldahl-Jodlbauer method as follows: Digest the fertilizer in 20 to 30 cc. of sulpho-phenic acid containing from 60 to 100 gm. of crystallized phenic acid per liter. For hastening solution it is recommended to heat slowly to about 40° C., cool and add 1 gm. of zinc powder in small portions, digest in the cold for at least 2 hours, then proceed as in the ordinary Kjeldahl method. The nitric nitrogen is determined by the Schloesing-Grandeau method.

In fertilizers containing the 3 forms of nitrogen the total nitrogen is determined by the Kjeldahl-Jodlbauer method, ammoniacal nitrogen by distillation with magnesia, and nitric nitrogen by the Schloesing-Grandeau method.

Phosphoric acid soluble in mineral acids.—To 50 gm. of the phosphate add 50 cc. of nitric acid (1.2 sp. gr.) or aqua regia and 50 cc. of water. Boil

for ½ hour, make volume to 500 cc., and filter. In case of substances rich in phosphoric acid, like precipitated phosphate, use 25 cc. of this solution for the subsequent determination; in case of the poorer phosphates, like superphosphates and slags, use 50 cc. Neutralize the greater part of the free acid with ammonia, precipitate in hot solution with 100 cc. of a solution of nitro-molybdate of ammonia, boil, and filter while hot. Wash with 100 cc. of 1 per cent nitric acid. Dissolve in as small amount as possible of ammonia of 0.96 sp. gr. Saturate the larger part of the ammonia with hydrochloric acid and precipitate in the cold with 10 cc. of magnesia mixture, adding 2 or 3 drops of the latter at first and stirring until precipitation commences, then add the rest of the solution at once. Add 50 cc. of strong ammonia (0.96 sp. gr.), allow to stand for 2 hours, filter, wash with 5 per cent ammonia, incinerate, and weigh. Calculate phosphoric acid with the factor 0.64. Substances containing a large amount of organic matter may be dissolved in sulphuric acid, as in the Kjeldahl method. Substances must not be prepared for the determination of phosphoric acid by incineration.

The citro-mechanical method is carried out with 25 cc. of a solution of phosphate, guano, or ground bone, or 100 cc. of a solution of superphosphate made as directed above, the acid being almost neutralized with ammonia, and 30 cc. of Petermann's citrate solution (see below) and 10 cc. of ammonia of 0.91 sp. gr. added. The solution is agitated for ½ hour, during which time 25 cc. of magnesia mixture is added, drop by drop. The precipitate is collected on a filter, washed, incinerated, and weighed.

Phosphoric acid soluble in water and ammonium citrate.—From 1 to 4 gm. of phosphate, according to its content of phosphoric acid, is ground up in a mortar, at first in a dry state, afterwards with 20 to 25 cc. of water, until a uniform mixture is obtained. The solution is decanted on to a filter, the filtrate being collected in a 250 cc. flask. This operation is repeated 3 times, when all of the material is thrown on to the filter and washed until the volume of the filtrate amounts to about 200 cc. A few drops of nitric acid is added if the phosphoric acid is to be precipitated by ammonium nitro-molybdate, or hydrochloric acid if the citro-mechanical method is to be used. The filter with the insoluble residue is placed in a 250 cc. flask with 100 cc. of alkaline ammonium citrate. In case of precipitated phosphates the previous extraction with water is omitted and the material is treated directly with the citrate. The insoluble residue is digested in the ammonium citrate in the cold for 15 hours with stirring, afterwards for 1 hour in a water bath at 40° C. The citrate extract, after cooling, is made up to 250 cc. and filtered. To a mixture of 50 cc. of this solution and 50 cc. of the water solution previously obtained 10 cc. of hydrochloric acid (1.1 sp. gr.) is added and the solution kept at the boiling point for 30 minutes to transform the metaphosphoric acid into orthophosphoric acid. The phosphoric acid is determined either by the molybdic or citro-mechanical method. If the former is used, previous boiling with hydrochloric acid is unnecessary,

Potash—general method.—In the analysis of potash salts 10 gm. of the material is placed in a liter flask with about 500 cc. of water and brought to the boiling point, just enough barium chlorid is added to precipitate the sulphuric acid, the volume made up to 1 liter, and filtered. To 20 cc. of this solution in case of sulphate and 50 cc. in case of kainit 10 cc. of 10 per cent platinum chlorid is added and the solution evaporated to a sirupy consistency. The residue is taken up in 85 per cent alcohol, the crystals carefully broken, the precipitate collected on a tared filter or Gooch crucible, washed with the alcohol, dried at 125° in an air or xylol bath, and weighed. The factor 1.94 is used in calculating potash.

Potash—special methods.—Under this head are described the Netherlands and the Corenwinder and Contamine methods. In the first, which is applicable to superphosphate of potash and mixed fertilizers, 20 gm. of substance is boiled with water for ½ hour, the solution cooled, and made up to 500 cc. To 50 cc. of the filtered solution at the boiling point just enough barium chlorid to precipitate the sulphuric acid is added, followed by the addition of an excess of barium hydrate. The solution is cooled, made up to 100 cc., and filtered. To 50 cc. of the filtrate ammonium carbonate and ammonia are added at the boiling point until no further precipitation occurs. The solution is cooled, made up to 100 cc., and filtered. Fifty cubic centimeters of the filtrate is evaporated and ignited to remove ammonium salts. The residue is taken up in water, filtered, and treated as in the general method.

In the method of Corenwinder and Contamine to 50 cc. of a solution of 10 gm. in 1 liter of water 1 cc. of hydrochloric acid is added and the solution evaporated and ignited just below redness to drive off ammonium salts and organic matter. The residue is taken up in water, acidulated with hydrochloric acid, and the solution evaporated to a sirupy consistency with the addition of 10 cc. of 10 per cent platinum chlorid. The precipitate is washed with 80 per cent alcohol and then redissolved in hot water, the solution being allowed to pass into 50 cc. of 10 per cent sodium formate kept at the boiling point. This solution is heated until reduction is complete and acidulated with hydrochloric acid, a large excess of the latter being carefully avoided. The platinum is collected on a filter, washed with cold water and ignited. The potash is calculated by multiplying the weight of platinum by 0.4835. The reduction may be made by means of mercurous chlorid, according to Mercier, instead of with sodium formate.

The determination of the fineness of mineral phosphates and slags.—Fifty grams of material is shaken up for 30 minutes in a sieve, the meshes of which are 0.17 mm. square, the actual size of the holes being 0.029 mm.

ANALYSIS OF FEEDING STUFFS.

Preparation of samples.—Samples are ground until they pass a sieve with 1 mm. meshes.

Determination of water.—Five grams of material is dried in an air bath at a temperature of from 100 to 105° C. to constant weight.

Determination of ash.—Five grams of the substance is incinerated in a muffle until the ashes are white or light gray. The Belgian law requires that the amount of matter in the ash insoluble in 10 per cent hydrocholoric acid shall be determined and that it shall not exceed 2 per cent.

Determination of crude protein.—Nitrogen is determined in 1 to 2 gm. of substance by the Kjeldahl method, the protein being calculated from the nitrogen by the use of the factor 6.25.

Determination of pure albuminoids.—This is done by means of Stutzer's method as follows: To 1 gm. of the substance is added 100 cc. of water and the solution brought to the boiling point, 2 to 3 cc. of a saturated solution of alum is added, and then a quantity of copper hydrate corresponding to about 0.4 gm. of copper oxid. After cooling the residue is collected on a filter, washed at first with water, and afterwards with alcohol. The nitrogen is determined in the filter and contents by the Kjeldahl method without previous drying. The factor 6.25 is used in calculating the albuminoids from the nitrogen thus found. If the substance contains an alkaloid it is first boiled on a sand bath with 100 cc. of alcohol containing 1 cc. of acetic acid. The solution thus obtained is decanted through the same filter, which is afterwards used for collecting the copper hydrate precipitate.

Determination of fat.—For this purpose 3 to 5 gm. of the substance is exhausted in one of the common forms of extractors with carbon tetrachlorid or ether. Commercial ether is redistilled with sodium before use for this purpose, and the sample is dried at 100° C. in the air or in a current of inert gas before extraction with the ether. The extract is collected in 100 to 150 cc. flasks, and after the solvent is driven off, dried for 2 hours at 98 to 100° C. in a hot-water bath and weighed. For the determination of substances other than fat which are dissolved by the ether, the residue is redissolved in ether, an equal volume of alcohol is added, the solution exactly neutralized, and evaporated to dryness. The residue is taken up in ether, filtered into a tared flask, the solvent driven off, and the residue dried for 2 hours and weighed as pure fat.

Determination of crude cellulose.—Three grams of the substance is boiled for ½ hour with 200 cc. of 1.25 per cent sulphuric acid, the liquid being maintained meanwhile at a constant level. After settling, the solution is decanted, and the residue is extracted twice in the same manner with 200 cc. portions of water. The different extracts are collected in one flask. After settling, the supernatant liquid is siphoned off, the residue is combined with that in the digestion flask, and the whole is treated as described above, first with 200 cc. of 1.25 per cent potassium hydrate, and then with 2 successive portions of 200 cc. each of water. The extracts thus obtained are treated as above

described. The residues are washed 2 or 3 times by decantation with boiling water, finally collected on a weighed filter, washed with hot alcohol and with ether, dried at 100° C., and weighed. The ash is determined in the residue thus obtained and its weight deducted in calculating the cellulose.

Cellulose is also determined by means of the Holdefleiss method. In this case 3 gm. of the material and 200 cc. of 1.25 per cent sulphuric acid are placed in a Holdefleiss flask and the solution kept at the boiling point for ½ hour by the injection of steam. The material is collected on an asbestus filter and washed with hot water until the filtrate is no longer acid. The residue is treated in the same manner with 200 cc. of potassium hydrate, the washing being continued in this case until the alkaline reaction disappears. The residue is then washed with alcohol and ether, dried, and weighed. It is then incinerated and weighed again. The difference between the two weights gives the crude cellulose.

PREPARATION OF SPECIAL REAGENTS.

Ammonium nitro-molybdate.—Dissolve 150 gm. of ammonium molybdate in 1 liter of distilled water, pouring the solution into 1 liter of nitric acid of 1.2 sp. gr.

Magnesia mixture.—Dissolve 100 gm. of crystallized magnesium chlorid, 200 gm. of crystallized ammonium chlorid, and 400 gm. of ammonia of 0.96 sp. gr. in water, making the volume up to 1,250 cc., and filter after standing 48 hours.

Alkaline ammonium citrate.—Dissolve 500 gm. of citric acid in just enough ammonia of 0.92 sp. gr. to give a neutral reaction (about 700 cc.). On cooling add water until the specific gravity is 1.09 at 15° C. Add 50 cc. of ammonia of 0.92 sp. gr. to each liter of this solution, stir, let stand for 48 hours, and filter. The specific gravity of the solution thus obtained is from 1.082 to 1.083.

Stutzer's reagent.—Dissolve 100 gm. of crystallized copper sulphate in 5 liters of water, add about 2 gm. of glycerin, and precipitate the cuprous hydrate by adding dilute soda solution until the reaction is faintly alkaline, filter, and diffuse the precipitate in water containing 5 gm. of glycerin per liter. Wash by decantation until the precipitate is free from excess of alkali. The precipitate is finally diffused in water containing glycerin and kept in a dark place in a closely stoppered flask. The amount of copper oxid in the reagent is determined by the evaporation and ignition of 10 cc. of it.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of citrate-soluble phosphoric acid in bone meal, superphosphates, etc., O. BÖTTCHER (*Chem. Ztg., 22* (*1898*), *No. 21, pp. 201, 202*).—Five grams of the substance is rubbed fine with a dilute acid ammonium citrate solution (1 volume of the concentrated solution mixed with 4 volumes of water), washed into a 500 cc. flask, which is then filled to the mark with the dilute acid citrate solution at the room temperature (about 17.5° C.). The flask is then closed with a rubber stopper and kept for 30 minutes in a rotating apparatus which revolves 30 or 40 times per minute. The mixture is now filtered and suitable portions of the liquid taken for the determination of phosphoric acid, either by the molybdate or the citrate method.—J. T. ANDERSON.

A contribution to the determination of potash, J. DIAMANT (*Chem. Ztg., 22* (*1898*), *No. 12, p. 99*).—The method proposed involves the reduction of potassium-platinum chlorid by means of zinc dust, and the volumetric determination of chlorin in the liquid residue. About 0.5 gm. of potassium-platinum chlorid (the amount taken of the potash compound to be analyzed being such as to yield about that amount of the double salt) is collected on a filter and washed in the usual way. It is then dissolved in hot water in a 500 cc. flask and the volume made to the mark with cold water. It is now shaken with about 1 gm. of zinc dust, when reduction begins instantly. When the color disappears, showing that reduction is complete, the liquid is filtered through a dry filter, and 250 cc. of it is used for the volumetric determination of chlorin.—J. T. ANDERSON.

A new method of determining fat in feeding stuffs, meat, feces, etc., L. LIEBERMANN and S. SZÉKELY (*Arch. Physiol.* [*Pflüger*], *72* (*1898*), *No. 7–8, pp. 360–366, fig. 1*).—The author describes in detail a method of determining fat as follows: Boil for half an hour 5 gm. of substance with 30 cc. of 50 per cent potassium hydroxid solution (sp. gr. 1.54), over a free flame, shaking frequently. This should be done in a flask of suitable shape which when filled to about the middle of the neck will contain about 290 cc., and has a mark at 240 cc. When cool add 30 cc. of 90 to 94 per cent alcohol and warm for about 10 minutes, then cool and add carefully, in small portions, 100 cc. of 20 per

cent sulphuric acid (sp. gr. 1.145), shaking frequently and cooling to prevent the loss of volatile fatty acids. The solution should contain an excess of about 4.4 gm. sulphuric acid. When the solution is quite clear add 50 cc. petroleum ether of good quality (sp. gr. 0.6 to 0.7, boiling point about 60°), close the flask tightly and shake thoroughly 30 times at intervals of 1 to 2 minutes. The cork should not be removed, since some of the petroleum ether would evaporate. Add sufficient saturated sodium chlorid solution to make 290 cc., shake a few times, and allow the flask to stand a short time in a cool place. The bottom of the petroleum ether layer should be at the 240 cc. mark on the neck of the flask. The petroleum ether will contain all the fatty acids in solution. Remove 20 cc. with a suitable pipette, dilute with 40 cc. of 96 per cent alcohol, add 1 cc. of phenolphthalien and titrate with an alcoholic solution of decinormal potassium hydroxid, noting the amount required. Evaporate in a suitable vessel with a glass cover upon a moderately warm water bath or in other convenient way, dry at 100° C. and weigh with the cover on the dish, since the potassium salts of fatty acids are hygroscopic.

The amount of fat in the original material can be calculated with the aid of the following formula:

$$F = \left[\frac{S - 0.01 - (K \times 0.00255)}{A}\right] 0.250.$$

F equals fat in original substance, S the weight of potassium salts of fatty acid in 20 cc. of petroleum ether, K the amount of potassium hydroxid solution used, and A the weight of the material taken.

Modifications of the method are given for use in determining the amount of fat in hay, flour, and grain, and comparisons of this method with the Soxhlet method of extraction. The results show that the method is accurate, and in the authors' opinion it can be recommended as being more rapid than the ordinary methods.

Determinations of fat by Liebermann's saponification method, F. TANGL and J. WEISER (*Arch. Physiol.* [*Pflüger*], *72* (*1898*), *No. 7–8*, *pp. 367–369*).—The authors determined the fat in a number of samples of meat and feces by the method described above and by Dormeyer's method (E. S. R., 7, p. 919). Equally good results were obtained in both cases. The first method is recommended as fully as accurate as Dormeyer's and less time consuming.

A simple method for the estimation of carbohydrates (**sugar, starch, dextrin**) **in foods and condiments,** F. GROMMES (*Sitzungsber. Phys.-med. Soc. Erlangen*, *29* (*1897*), *pp. 17–28*, *fig. 1*).—The author describes Fleischer's apparatus and method for determining the sugar content of foods and beverages. The apparatus is shown in the accompanying figure (fig. 9). The method for determining sugar in wine, beer, and other liquids is as follows: A sample of the liquid, decolorized with animal charcoal (if this is necessary), is boiled with

potassium hydroxid or sodium hydroxid solution to determine something of the amount of sugar which it contains and how much it is desirable to dilute the material before estimating the sugar. If a deep brown color is obtained the wine, beer, or liquid should be much diluted. If the color is faint less dilution is necessary. After diluting a known quantity of the material, yeast is added and it is placed in the Fleischer apparatus, the apparatus tightly closed and allowed to remain in a warm place for 24 hours. The carbon dioxid produced causes the column of mercury (1) to rise in the graduated tube. The amount of sugar is calculated by making a control experiment under the same conditions with a solution containing a known amount of dextrose.

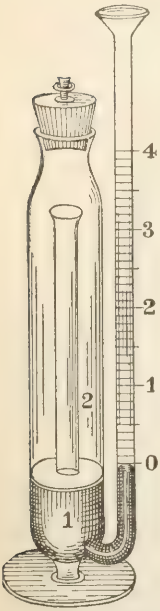

FIG. 9.—Fleischer's apparatus.

In case of vegetables, etc., the finely divided material is extracted with water until a qualitative test shows that sugar is no longer obtained. The sugar in the aqueous extract is then determined as above.

In case of flour, bread, and similar materials the starch was also determined. The material, carefully dried, was inverted by boiling with dilute hydrochloric acid and the total dextrose determined as above. The difference between this result and the sugar in the original substance showed the dextrose derived from starch. The starch could then be calculated.

The author reports the results of numerous determinations, some of which are shown in the following table:

Sugar and starch in a number of food materials.

	Sugar.	Starch.
	Per cent.	*Per cent.*
Potatoes, raw	2.876–2.634	....
Potatoes, cooked	2.037–1.873	....
Carrots	7.210	....
Orange peel	14.570	....
Lemon peel	18.960	....
Lemon without peel	3.133	....
Orange without peel	24.640–22.976	....
Pears	14.259–16.375	....
Apples	12.153–14.919	....
Plums	4.170	....
Dates	64.270–58.840	....
Rye flour	1.885	60.76
Wheat meal (Gries mehl)	2.500	63.45
Wheat flour	3.820	65.36
Barley flour	5.450	59.16
Oatmeal	3.76	63.52
Corn meal	4.29	60.92
Kommis bread	1.758	*a* 46.36
Graham bread	1.805	*a* 21.76
Black bread	2.514	*a* 45.33
White bread	2.538	*a* 48.69
Roman bread	3.224	*a* 42.93
"Erlangen kipf" bread	3.696	*a* 54.29
Pumpernickel	13.559	*a* 41.87
Tea cakes	4.532	*a* 38.64
Almond bread	1.494	*a* 8.51

a Starch and dextrin.

The sugar content of different food materials is discussed in relation to the diet of patients suffering from diabetes.

A new method for drying feces, H. PODA (*Ztschr. Physiol. Chem.*, *25* (*1898*), *No. 3–4*, *pp. 355–359*).—The author proposes to simplify the drying of feces for analysis by adding absolute alcohol, which assists in driving off the water. The fresh material is dried in a porcelain dish on a water bath for from 4 to 6 hours, at the end of which time it is usually solid when cooled. It is then mixed in the same dish with 50 cc. of absolute alcohol, being broken up into small pieces, and dried on the water bath for about an hour, when the operation is repeated with 25 cc. of alcohol. It is then usually dry enough so that it can be ground in the dish to a fine powder, but if not it is treated again with 25 cc. of alcohol and dried. The material, which contains from 2 to 5 per cent of water, is placed in portions of 2 or 3 gm. in beakers and dried in an air bath at 99 to 100°.

A table is given showing the time required for drying feces with and without treatment with alcohol. The author concludes that the method is a simplification of the ordinarily tedious process, being more rapid and requiring less attention, and giving more accurate results.

The albuminoids, P. NOLF (*Ann. Inst. Pasteur*, *12* (*1898*), *No. 7*, *pp. 471–480*; *8*, *pp. 547–560*).—A critical review of the subject.

Concerning the constitution of the simplest albuminoids, A. KOSSEL (*Ztschr. Physiol. Chem.*, *25* (*1898*), *No. 3–4*, *pp. 165–189*).—This deals with the "protamins" clupein, salmin, and sturin, their constitution, decomposition products, relation to albuminoid bodies, etc.

The cleavage of crystalline egg and serum albumin and of serum globulin by pepsin digestion, F. UMBER (*Ztschr. Physiol. Chem.*, *25* (*1898*), *No. 3–4*, *pp. 258–282*) — The method of work and the characteristics of the different factions obtained from each of these albuminoids are described.

The cleavage products of the proteids prepared from conifer seeds, E. SCHULZE (*Ztschr. Physiol. Chem.*, *25* (*1898*), *No. 3–4*, *pp. 360–362*).—A continuation of a former paper.

Concerning nuclein, P. NOLF (*Ann. Inst. Pasteur*, *12* (*1898*), *No. 5*, *pp. 361–368*).—Reviews literature and gives present status of the subject.

The active constituents in castor oil, H. MEYER (*Sitzber. Gesell. Beförd. Gesam. Naturwiss. Marburg*, *1896*, *pp. 23, 24*).

Effect of neutral salts upon glucose at high temperatures, H. C. PRINSEN-GEERLIGS (*Ztschr. Spiritusind.*, *21* (*1898*), *No. 27*, *p. 243*).

Inversion of sugar by neutral salts in the presence of glucose, H. C. PRINSEN-GEERLIGS (*Ztschr. Spiritusind.*, *21* (*1898*), *No. 30*, *p. 266*).

The chemistry of chlorophyll, L. MARCHLEWSKI (*Jour. Prakt. Chem.*, *n. ser.*, *57* (*1898*), *p. 330*).

A review of Marchlewski's contribution on the chemistry of chlorophyll, G. BODE (*Jour. Prakt. Chem.*, *n. ser.*, *57* (*1898*), *pp. 488–493*).

Report of the committee of the agricultural experiment stations and laboratories on the methods of analysis of fertilizers (*Bul. [Min. Agr. France]*, *16* (*1897*), *No. 2*, *pp. 219–251*).—This report deals with the following topics:

Preliminary examination of fertilizers, including qualitative tests for potash, phosphoric acid, ammonia, nitric acid, and organic nitrogen; the sampling of fertilizers, including the taking of samples and their preparation in the laboratory; the determination of potash in muriate, sulphate, and complex forms of potash by

means of perchloric acid according to Schloesing, in the form of double chlorid of platinum potassium, and by the method of Corenwinder and Contamine (E. S. R., 9, p. 416); the determination of nitrogen in different forms, including organic nitrogen by means of soda lime in fertilizers rich and poor in nitrogen but containing no nitrates, by the method of Grandeau in substances which are difficult to mix and pulverize, in all three forms in a mixed fertilizer, and by the Kjeldahl method, ammonia in ammonium sulphate by the Schloesing apparatus, ammonia in a complex fertilizer, and nitric acid in nitrates by the Schloesing method; the determination of phosphoric acid in different forms, including natural phosphates of lime, precipitated phosphates, guanos, poudrettes, etc.; the determination of phosphoric acid by the molybdic method, of soluble phosphoric acid in superphosphates and chemical fertilizers, phosphoric acid in sulphuric acid solutions, the degree of fineness of phosphates, and the examination of phosphatic slags.

Gladding's method for phosphoric acid, J. B. COPPOCK (*Chem. News, 77 (1898), No. 2000, p. 242*).—This is a comparison of the magnesia and Gladding[1] methods on boiled bones and superphosphates. In the tests made there was a very satisfactory agreement between the results obtained by the two methods. Although somewhat higher percentages were obtained by the Gladding method, the author concludes that the Gladding method is reliable enough for fertilizer work and has the advantage of being very rapid.

Determination of phosphorus in steel, iron, and iron ores, J. OHLY (*Chem. News, 76 (1897), No. 1978, p. 200*).

Volumetric estimation of combined sulphuric acid, F. TELLE (*Jour. Pharm. et Chim., 6. ser., 7 (1898), No. 4, p. 165*).—The sulphuric acid is precipitated with barium chlorid after acidulating with hydrochloric acid; the excess of baryta is precipitated with potassium bichromate, and finally the excess of chromate is estimated, by the iodin displaced, by sodium thiosulphate.—B. H. HITE.

On Fehling's solution, O. ROSENHEIM and P. SCHIDROWITZ (*Chem. News, 76 (1897), No. 1988, p. 318; 1997, p. 97*).—A reply to a paper by Jovitschitsch[2] and Siegried.[3] The authors maintain that alkali salts of mineral acids (hydrochloric, nitric, and sulphuric) do not possess the property of reducing Fehling's solution.—B. H. HITE.

A quick polarimetric method for the estimation of starch in flour, etc., E. DOWZARD (*Chem. News, 77 (1898), No. 1998, p. 107*).—One gram of the flour is mixed with a little cold water, 35 cc. of boiling water added, the mucilage kept at 100° for ½ minute, cooled to 48°, and treated with 20 cc. of a 10 per cent malt-extract solution that has been shaken with kaolin and filtered. The mixture is kept at 48° for 20 minutes, brought just to boiling, and filtered. The cooled filtrate is made up to 100 cc., a small quantity of kaolin added, filtered again, and the optical rotation taken in a 20 cm. tube. The optical rotation of the malt-extract solution and of the dextrin in the flour must be deducted.—B. H. HITE.

The estimation of carbohydrates (sugar, starch, and dextrin) in foods and condiments by a simple method, F. GROMMES (*Die Bestimmung der Kohlehydrate (Zucker, Stärke, Dextrin) in beliebten Nahrungs- und Genussmitteln vermittels einer leicht ausführbaren Methode. Inaug. Diss., Erlangen, 1897, pp. 178; abs. in Hyg. Rundschau, 8 (1898), No. 11, pp. 550, 551*).—This is a full account of work reported above (p. 311).

The different methods of determining the quantity of starch in cereals, P. BIOURGE (*Bul. Assoc. École Superior de Brasserie Univ. Louvain, 1898, No. 1*).

On testing for diastase from barley, P. TERRAT (*Jour. Pharm. et Chim., 6. ser., 6 (1897), No. 11, p. 494*).

A note on the detection of maize starch and maize flour in mixture with wheat flour, E. E. EWELL (*Jour. Appl. Micros., 1 (1898), No. 6, pp. 100, 101*).

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[1] Jour. Amer. Chem. Soc., 18 (1896), p. 23 (E. S. R., 7, p. 650).

[2] Ber. Deut. Chem. Gesell., 30 (1897), p. 2435.

[3] Ibid., p. 3133.

On the estimation of glycerin in the analysis of wax, F. BEILSTEIN and R. RINNE (*Bul. Acad. Imp. Sci. St. Petersburg, 5. ser., 5 (1896), No. 5, pp. 285–291*).

A study of the nitrogen contained in wine, J. LABORDE (*Ann. Inst. Pasteur, 12 (1898), No. 8, pp. 517–540*).

Characteristic reaction for cotton-seed oil, G. HALPHEN (*Jour. Pharm. et Chim., 6. ser., 6 (1897), No. 9, p. 392*).—Equal parts (about 1 to 3 cc. each) of amyl alcohol, the oil to be tested, and carbon bisulphid containing 1 per cent of sulphur in solution, are mixed in a test tube and heated 10 to 15 minutes in a bath of boiling salt water. "Only cotton-seed oil will give a red color by this treatment."—B. H. HITE.

Determination of tannin, L. VIGNON (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 8, pp. 369–372*).

Estimation of chlorin, bromin, and iodin in saline waters, P. A. E. RICHARDS (*Chem. News, 76 (1897), No. 1986, p. 293*).

Zinc in water, P. A. E. RICHARDS (*Chem. News, 76 (1897), No. 1986, p. 293*).

Introduction to the micro-chemical analyses of the most important organic compounds, BEHRENS (*Anleitung zur mikrochemischen Analyse der wichtigsten organischen Verbindungen. Hamburg and Leipsic: L. Voss, 1897, pt. 4, pp. 128, figs. 91; rev. in Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 2–3, p. 101*).

A new asbestus filter tube, A. GOSKE (*Chem. Ztg., 22 (1898), No. 4, p. 21, fig. 1*.—A conical stricture is made in a combustion tube, and into this stricture a small hollow perforated ball is fitted. The asbestus is lightly packed around and over this ball.—J. T. ANDERSON.

A new filter apparatus with a two-way cock and attached arms running out on two sides (*Chem. Ztg., 22 (1898), No. 6, p. 39, fig. 1*).—Especially useful in cases where precipitates are to be washed with 2 liquids in succession and it is desired to collect the wash liquids separately. The 2 arms of the apparatus are connected with separate receptacles, and by turning the stopcock properly the liquid from the funnel may be made to flow into the one or the other at pleasure.—J. T. ANDERSON.

A practical filter stand, H. FABER (*Chem. Ztg., 22 (1898), No. 6, pp. 39, 40, fig. 1*).—Two circular discs of unequal diameters are securely fastened together at a fixed distance apart, one over the other, and so supported on a vertical axis that they may revolve together around it. The upper disc is the smaller and has a circle of holes near the rim at suitable distances apart to hold the funnels. The filter glasses and the beakers both rest below on the other disc. A slight modification is suggested by which the smaller disc is made of adjustable height above the lower. Economy of space on the work table is the advantage claimed for this stand.—J. T. ANDERSON.

An easily constructed apparatus for fractional distillation in vacuo, R. L. STEINLIN (*Chem. Ztg., 22 (1898), No. 18, pp. 157, 158, figs. 2*).

An efficient gas-pressure regulator, P. MURRILL (*Jour. Appl. Micros., 1 (1898), No. 5, pp. 92–94, figs. 4*).

On the reaction of filter paper, L. MAGNIER (*Jour. Pharm. et Chim., 6. ser., 6 (1897), No. 10, p. 438*).—The statement is made that filter papers always retain a small quantity of acid, no matter how well they are washed with cold water. Prolonged washing with boiling water removes the last traces of acid.—B. H. HITE.

Chemical department, E. F. LADD (*North Dakota Sta. Rpt. 1897, pp. 9–10*).—A summary of the work of this department of the station during the year, including a summary of observations on temperature and rainfall; analyses of 9 samples of soil, 7 of baking powders, and 4 of corn fodder, with notes on the examination of well waters and on sugar beets grown in different parts of the State.

Report of the chemist, W. R. PERKINS (*Mississippi Sta. Rpt. 1897, pp. 8–10*).—This is a brief account of the work of the year in this department of the station, including a note on the soil work which has been undertaken by the station, analyses (mineral constituents) of 4 samples of artesian water, determinations of nitrogen in rainfall 1894–1897, and a statement of miscellaneous chemical work.

BOTANY.

Review of the investigations of the grain rust, J. ERIKSSON (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 94–109; also Bot. Gaz., 25 (1898), No. 1, pp. 26–38, and Rev. Gén. Bot., 10 (1898), No. 110, pp. 33–48, fig. 1*).—The paper gives the main results of the investigations of the grain rust conducted by the author since 1890 at the State agricultural experiment station at Albano, Sweden. The conclusions to which the results have led are summarized as follows:

The fungi which cause rust disease in the cereals are at least 10 in number, partly species, partly specialized forms of species, and the spreading of disease between different grain crops and grasses is thereby materially restricted. Prior to 1890 the recognized species of grain rust fungi were the common grain rust, *Puccinia graminis*, the æcidial form of which was *Æcidium berberidis;* smaller grain rust, *P. rubigo-vera*, æcidial form *Æ. asperifolii;* and crown rust, *P. coronata*, æcidial form *Æ. rhamni.* The author recognizes 8 species, having divided them as follows: *P. graminis* into (1) *P. graminis* and (2) *P. phlei-pratensis; P. rubigo-vera* into (3) *P. glumarum*, (4) *P. dispersa*, and (5) *P. simplex;* and *P. coronata* into (6) *P. coronifera*, (7) *P. coronata*, and (8) an unnamed species. Each of these is considered to have developed specialized forms as follows:

(1) *P. graminis*, black rust, *Æcidium berberidis.*—Forms (*a*) *secalis* on *Secale cereale, Hordeum vulgare, H. jubatum, Triticum caninum, T. desertorum, T. repens, Elymus arenarius*, and *Bromus secalinus;* (*b*) *avenæ* on *Avena sativa, A. elatior, A. sterilis, Dactylis glomerata, Alopecurus pratensis, Milium effusum, Lamarkia aurea*, and *Trisetum distichophyllum;* (*c*) *tritici* on *Triticum vulgare;* (*d*) *airæ* on *Aira cæspitosa;* (*e*) *agrostidis* on *Agrostis cania, A. stolonifera*, and *A. vulgaris;* and (*f*) *poæ* on *Poa compressa* and *P. cæsia.*

(2) *P. phlei-pratensis*, timothy rust, on *Phleum pratense* and *Festuca elatior*, æcidium unknown.

(3) *P. glumarum*, yellow rust.—Forms (*a*) *tritici* on *Triticum vulgare*, (*b*) *secalis* on *Secale cereale*, (*c*) *hordei* on *Hordeum vulgare*, (*d*) *elymi* on *Elymus arenarius*, and (*e*) *agropyri* on *Triticum repens*, æcidium unknown.

(4) *P. dispersa*, brown rust, *Æcidium anchusæ.*—Forms (*a*) *secalis* on *Secale cereale*, (*b*) *tritici* on *Triticum vulgare*, (*c*) *agropyri* on *T. repens*, and (*d*) *bromi* on *Bromus arvensis* and *B. brizæformis.*

(5) *P. simplex*, dwarf rust, on *Hordeum vulgare*, æcidium unknown.

(6) *P. coronifera*, crown rust, *Æcidium cathartica.*—Forms (*a*) *avenæ* on *Avena sativa*, (*b*) *alopecuri* on *Alopecurus pratensis* and *A. nigricans*, (*c*) *festucæ* on *Festuca elatior*, (*d*) *lolii* on *Lolium perenne*, (*e*) *glyceriæ* on *Glyceria aquatica*, (*f*) *holci* on *Holcus lanatus* and *H. mollis.*

(7) *P. coronata*, crown rust, *Æcidium frangulæ.*—Forms (*a*) *calamagrostis* on *Calamagrostis arundinacea* and *C. lanceolata*, (*b*) *phalaridis*

on *Phalaris arundinacea*, (*c*) *agrostidis* on *Agrostis vulgaris* and *A. stolonifera*, (*d*) *agropyri* on *Triticum repens*, and (*e*) *holci* on *Holcus lanatus* and *H. mollis*.

(8) Species undescribed.—Forms (*a*) *epigæi* on *Calamagrostis epigeios* and (*b*) *melicæ* on *Melica nutans*.

In addition studies not yet completed have shown that besides the black rust of the 23 grasses given, the rusts found on the following species of grasses have been found to be true forms of black rust: *Aira flexuosa*, *Alopecurus nigricans*, *Elymus glaucifolius*, *Panicum miliaceum*, *Phleum boehmeri*, *P. michelii*, *Poa chaixii*, *P. pratensis*, and *Triticum unicum*.

Spreading of rust is often insignificant (1) between small grains and grasses that may carry the same specialized fungus forms; (2) from and to the plant species carrying winter rust in case such form is found; and (3) occasionally between different cultural forms of the same grain species.

The viability of summer and winter rust spores is in many cases small or at least uncertain.

The spreading of the rust depends to a large extent on the distance. In a circular recently issued by the Swedish Agricultural Department it is ordered that no barberry, whether wild or planted, be allowed to grow at a distance less than 25 to 50 meters (82 to 164 ft.) from grain fields.

The viability of the winter spores is dependent on certain exterior conditions (moisture, temperature, etc.) and is limited to a short time.

The yellow rust appears on certain particularly susceptible kinds of wheat and barley 4 to 5 weeks after sowing

The intensity of the yellow rust has sometimes proved greater on open than on shaded parts of the same field.

Shoots of wheat which early in the spring were enclosed in wide glass tubes closed at both ends with cotton, developed stalks which were rusty after 6 to 8 weeks. In the same way barley plants of a kind easily attacked by yellow rust, grown in sterilized soil and protected against contagion from without during the entire growing period, have in certain cases after 6 to 8 weeks become infected with yellow rust.

The fungus lives for a long time a latent life in the cells of the germ, and shortly before the appearance of rust spots, in the presence of favorable outer conditions changes to a visible mycelium.

The general conclusion is therefore drawn that the appearance of the grain-rust disease depends primarily upon a disease germ present in the plant itself, which in certain cases is inherited from the mother plant in the seed grain and lives there, as well as in the plant grown from the seed, a latent life as "mycoplasma;" and, secondarily, on infection from without from diseased neighbors. The intensity of the disease depends (1) on the energy with which prevailing external con-

ditions (weather, soil, manuring, etc.) are able to bring the disease germ from the latent stage to the visible mycelium and (2) on the supply of new infectious material from without.—F. W. WOLL.

The micro-organisms of the tubercles on the roots of leguminous plants, M. MAZÉ (*Ann. Inst. Pasteur, 12 (1898), No. 1, pp. 1–25; 2, pp. 128–155, pls. 2, fig. 1*).—The author reports an extended investigation of the physiology and morphology of the organism which causes the development of tubercles on the roots of leguminous plants and through which the assimilation of atmospheric nitrogen takes place.

In his general conclusions he states that the free micro-organisms in the soil are attracted toward the roots of leguminous plants by the intervention of carbohydrates diffused in the soil in the vicinity of the root hairs. The organisms penetrate the tissues and cause the formation of a meristematic growth which gives rise to the tubercles. Before the tubercles are formed the organisms are engulfed in a glutinous body which has somewhat the aspect of a mycelium. Later, by the circulation of the sap of the plant into the tubercles, this glutinous material is carried throughout all parts of the plant, and the bacteria are also exposed to the action of the acids dissolved in the plant juices. The pseudo-mycelium does not constitute a part of the living organism. Investigation has failed to show the presence of the organism in this mycelium by any of the means adopted. By the time the plant is matured the tubercles are deprived of their nutrition and the bacteria issue from the tubercles in the form of a bacillus endowed with new properties and capable of living free in the soil.

The fixation of free nitrogen can be brought about in artificial cultures as well as in the root tubercles. The author found that the addition of saccharose to various culture media and the thorough aeration of the medium admitted a growth of the organism that was capable of fixing the free nitrogen. The proportion between the amount of nitrogen fixed and the saccharose furnished to the organism was somewhat constant. When 2 per cent was added to the medium, a little more than double the amount of nitrogen was fixed than when only 1 per cent was used. All the forms which are found in nature may be reproduced in artificial media by the action of heat, acid, peptonized media, etc.

The bacteria recently isolated from the tubercles retain for some time their ability to reproduce new tubercles by inoculation. The forms differentiated during the saprophytic life are gradually lost. The author states that the saprophytic forms in the soil are undoubtedly able to establish themselves on roots and form tubercles, but that he has so far been unable to isolate them from the soil. The independent forms of the root tubercle organism are said to represent a state of dissociation; the first a bacterium which bears endogenous spores; the other an Oospora which bears conidia. The last state is usually borne upon the surface of the soil. The bacteria spread during the winter

and the Oospora form is met with toward the end of the summer. The author states that this method of development will be found to occur frequently among lower organisms and that it will apply to a great number of plants and lower animals.

The micro-organisms of the Leguminosæ are in many cases pathogenic to certain animals.

Notes on the salt-marsh plants of northern Kansas, J. H. SCHAFFNER (*Bot. Gaz., 25 (1898), No. 4, pp. 255–260*).—The author reports upon studies of the vegetation of the salt marshes and springs, which are said to be quite common in central Kansas. The particular region reported upon was visited in August, 1897, and consists of a marsh about 7 miles long, which varies from a quarter of a mile to a mile in width. The conditions in the vicinity of this marsh are said to be quite natural, no cultivation having been attempted near it. Another region was visited the same season and some notes relative to the flora of this marsh are appended.

The author's summary relative to the flora of these salt marshes is as follows:

"(1) The salt marshes of northern Kansas are characterized by large areas absolutely destitute of vegetation; by the paucity of species around their margins; and by the entire absence of all woody plants.

"(2) The vegetation of the streams flowing through them consists of diatoms and the three sedges, *Scirpus pungens, S. campestris*, and *S. lacustris*.

"(3) The three characteristic plants in and about the barren portion are *Distichlis maritima, Polygonum ramosissimum*, and *Suæda diffusa*, of which the Suæda is by far the least abundant.

"(4) The plants which may be regarded as successful invaders are the following: *Iva ciliata, Sporobolus heterolepis, S. texanus, Atriplex expansa, Aster multiflorus, Ambrosia psilostachya*, and *Hordeum jubatum*. *Sporobolus texanus* has never been reported, I believe, beyond the southern part of Kansas. Its abundance in the northern tier of counties of Kansas extends its northern limit nearly 200 miles.

"(5) Among the less successful invaders which are quite common are the following: *Panicum crus-galli, P. virgatum, Euphorbia marginata, E. glyptosperma, Chenopodium hybridum, Polygonum persicaria, P. hydropiper, Amarantus chlorostachys, Datura stramonium, Solanum rostratum, Xanthium strumarium, Helianthus annuus, Œnothera biennis, Gaura parviflora, Elymus virginicus*, and *Spartina cynosuroides*."

Investigations on the root development of some forage plants, C. C. GEORGESON and J. E. PAYNE (*Kansas Sta. Bul. 75, pp. 212–222, pls. 6*).—The various plants whose root systems were investigated were the black-eye cowpea, soy bean, Canada field pea, peanut, alfalfa, common millet, Hungarian millet, German millet, African millet, sorghum, pearl millet, Jerusalem corn, white and yellow millo maize, red and white Kafir corn, brown durra, several varieties of field corn, oats, grasses, and sunflower. The soil was dug and washed away from the roots, and their lateral and vertical penetration was measured. The distribution of the roots in the soil as ascertained by the investigation is indicated in the plates in such way as to show the relative root and top development. The widest lateral penetration of any of these roots

was 7 ft. in the case of the cowpea, and the deepest penetration was 6 ft. in the case of one of the varieties of corn.

The authors have conducted an experiment to ascertain the effect of different depths of planting on the development and secondary roots of corn. The corn was planted in pots ½, 1, 2, 3, 4, 5, 6, and 7 in. below the surface. After the plants had grown for 30 days all were taken from the pots and examined, and it was found that the first whorl of secondary roots originated approximately at the same distance beneath the surface of the soil in all cases. The effect of deep and shallow cultivation on the position and development of corn roots was investigated, and it was found that there was but little difference in the depth to which the roots penetrated. Nearly all the plants examined for depth of root development sent their roots down 4 or more feet. The lateral spread of the roots was found to be influenced very materially by the depth of cultivation and method of planting.

The effect of subsoiling on root development of corn was investigated in a limited way. Plants grown on subsoiled plats showed a somewhat greater penetration than those on plats not subsoiled.

The authors, from the work done, do not feel justified in drawing any general conclusions, and merely make a record of the facts as observed and express the hope that the work may serve to induce others to investigate the root development of plants.

Report of the botanical department, H. L. BOLLEY (*North Dakota Sta. Rpt. 1897, pp. 27–29*).—The author briefly reviews the work of his department, stating that the investigations have been confined largely to the principles of culture of field crops and the study of diseases of crops. Some attention has been given to the native plants, and a considerable addition to the herbarium is reported. Bacteriological investigations have occupied a portion of the author's time.

Culture tests of Tricholoma nudum, J. COSTANTIN and L. MATRUCHOT (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 11, pp. 853–856*).

On impregnating the woody fiber of living trees with coloring solutions, I. SHEVIRYEV (*Trudi Imp. St. Petersburg Obstchestva Yestyestroispitatyelyei, 25; abs. in Selsk. Khoz. i Lyesor., 185 (1897), p. 240*).—Among other things the author notes the importance of finding a substance which can be introduced into living plants in sufficient quantity to destroy parasites without injuring the plants. A method was discovered by which desired quantities of solutions could be introduced into the roots without injuring the plants, but to find a substance which will destroy parasites when so introduced will require further investigation.—P. FIREMAN.

An investigation concerning the assimilation of free nitrogen by algæ, P. KOSSOVICH (*Trudi Imp. St. Petersburg Obstchestva Yestyestroispitatyelyei, 26; abs. in Selsk. Khoz. i Lyesor., 186 (1897), pp. 237, 238*).—The author concludes that the lower algæ can not assimilate free nitrogen and that the observed increase in the nitrogen content of the soil covered with algæ and nonchlorophyl-bearing organisms is due to some of the latter.—P. FIREMAN.

Concerning the influence of formic aldehyde on germination, W. KINZEL (*Ztschr. Spiritusind., 21 (1898), No. 26, p. 233*).

Origin and structure of lenticels, H. DEVAUX (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 20, pp. 1432–1435*).

A contribution to the biology of flowers, P. KNUTH (*Bot. Centbl., 75 (1898), No. 6–7, pp. 161–163*).

On the demonstration of nuclear division in the circulating protoplasm of a cell, D. W. DENNIS (*Jour. Appl. Micros., 1 (1898), No. 5, p. 73*).

The demonstration of karyokinesis, B. F. KINGSBURY (*Jour. Appl. Micros., 1 (1898), No. 5, pp. 80–83*).

Experimental cytology, A. LABBÉ (*Paris: Carré & Naud, 1898, pp. VIII + 191*).

Nuclear division in the basidia and the phylogemy of the Basidiomycetes, H. O. JUEL (*Jahrb. Wiss. Bot., 32 (1898), No. 2, pp. 361–388, pl. 1*).

Concerning the centrosomes of the animal cell and their homologues in plant organs, B. NEMEC (*Anat. Anzeiger, 14 (1898), No. 22–23, pp. 569–580, figs. 18*).

On the metabolism and structure of halophytes, B. DIELS (*Jahrb. Wiss. Bot., 32 (1898), No. 2, pp. 309–322*).

On the occurrence of calcium oxalate crystals in the embryo of some leguminous plants, J. C. CASTRONOVO (*Atti Accad. Sci. Nat. Catania, 4. ser., 11 (1898), p. 39, pl. 1*).

Contributions to the knowledge of geotropic movements of plants, F. CZAPEK (*Jahrb. Wiss. Bot., 32 (1898), No. 2, pp. 175–308, figs. 7*).

Practical plant physiology, W. DETMER (*New York: The Macmillan Co., 1898, pp. 19+555*).—This is a translation by S. A. Moor of the second German edition of this work. It is an introduction to original research for students and teachers of natural science, medicine, agriculture, and forestry.

Introductory lecture in a course of vegetable physiology applied to agriculture, P. P. DEHÉRAIN (*Ann. Agron., 24 (1898), No. 5, pp. 193–214*).

Concerning the physiological action of arsenic on vegetable organisms, J. STOKLASA (*Ztschr. Landw. Versuchw. Oesterr., 1 (1898), p. 154; abs. in Bot. Centbl., 75 (1898), No. 10, pp. 304, 305*).

A contribution to the subject of the nitrogen nutrition of leguminous plants, J. LUTOSLAWSKI (*Ber. Physiol. Lab. Landw. Inst. Halle, 1898, No. 14, pp. 32*).

Secondary growth of the fibrovascular bundles in monocotyledons, M. C. QUEVA (*Assoc. Francaise Avanc. Sci., 1897, pp. 469–472*).

A practical photomicrographical camera, H. BAUSCH (*Jour. Appl. Micros., 1 (1898), No. 5, pp. 94, 95, figs. 2*).

A text-book of microphotography, R. NEUHAUSS (*Lehrbuch der Microphotographie. Brunswick: Harold Bruhn, 1898, 2. ed., pp. XV+266, pls. 4, figs. 62*).

Notes on microscopic technique, G. C. HUBER (*Jour. Appl. Micros., 1 (1898), No. 6, pp. 102–105*).

Apparatus for removing air from mounted slides and material, D. T. MACDOUGAL (*Jour. Appl. Micros., 1 (1898), No. 4, pp. 73, 74, fig. 1*).

An improved form of wash bottle for microscopists, W. C. STURGIS (*Jour. Appl. Micros., 1 (1898), No. 4, pp. 75, 76, fig. 1*).

The use of soap for embedding plant tissues, E. M. WILCOX (*Jour. Appl. Micros., 1 (1898), No. 4, pp. 68, 69*).

An improved form of paraffin embedding table, H. B. WARD (*Jour. Appl. Micros., 1 (1898), No. 5, pp. 88, 89, fig. 1*).

A method for improving paraffin for section cutting, F. SMITH (*Jour. Appl. Micros., 1 (1898), No. 4, pp. 67, 68*).

Some points on the technique of paraffin embedding, F. H. LAMB (*Jour. Appl. Micros., 1 (1898), No. 4, pp. 63, 64, figs. 5*).

A combination of the paraffin and celloidin methods of embedding, U. DAHLGREN (*Jour. Appl. Micros., 1 (1898), No. 4, p. 67*).

Work of the ichthyological section of the Russian society of acclimatization of animals and plants (*Moscow, 1897, vol. 2, pp. 272, pls. 2; abs. in Selsk. Khoz. i Lyesov., 185 (1897), Apr., p. 241*).

FERMENTATION—BACTERIOLOGY.

Report of the agricultural-bacteriological laboratory, 1896, A. THEOKTISTOV (*Selsk. Khoz. i Lyesor, 185 (1897), Jan., pp. 1–4*).—The work of the Government laboratory during the year 1896 was confined mainly to studies of cultures of bacilli which kill field mice. Preparations were completed for field experiments in the destruction of marmots (*Spermophilus fulvus*) through the agency of bacteria. Four species of bacteria were studied both microscopically and biologically. The investigation is to be published in detail later. The number of shipments of these bacteria cultures to correspondents and the amount of culture shipped is noted. Experiments were also made to determine whether the disease caused by these bacteria is transmitted by means of the excrement of diseased mice. It was found that the disease was readily transmitted in this way. A more complete account of the results is to be given later.—P. FIREMAN.

On the morphology of the yeasts, A. SCHYDLOWSKY (*Zootomiches Lab. Kl. Univ. Charkow, 1897, p. 100, pl. 1*).

Cytological studies of yeast, F. A. JANSSENS and A. LEBLANC (*Cellule, 14 (1898), No. 1, pp. 203–243, pls. 2; abs. in Bot. Centbl., 75 (1898), No. 10, pp. 301, 302*).

Variation in beer yeasts and other saccharomycetes, E. C. HANSEN (*Ztschr. Gesam. Brauw., 1898, No. 18, pp. 219–221; 19, pp. 234, 235*).

New investigations on the subject of yeast fermentation, VORNHECKE (*Jahresber. Westfäl. Provinz. Ver. Münster, 25 (1896–97), pp. 134–136*).

Ammoniacal fermentation due to molds, O. SEMAL (*Ann. Pharm., 1898, No. 7*).

The sterilization of musts and yeasts, A. M. DESMOULINS (*Monit. Vin., 1898, No. 44, pp. 173, 174*).

On the destruction of typhoid bacteria in cider, E. BODIN (*Ann. Inst. Pasteur, 12 (1898), No. 7, pp. 458–464*).—The author states that typhoid bacteria in cider are killed in from 2 to 18 hours.

A method of preserving culture media, F. T. BIOLETTI (*Jour. Appl. Micros., 1 (1898), No. 4, pp. 72, 73*).

Agar-agar: The preservation of culture media, M. P. RAVENEL (*Jour. Appl. Micros., 1 (1898), No. 6, p. 106*).

The artichoke as a medium for bacteria, M. ROGER (*Compt. Rend. Soc. Biol., 5 (1898), pp. 769–771; abs. in Bot. Centbl., 75 (1898), No. 10, pp. 300, 301*).

Concerning the plasmolysis of bacteria, W. PODWYSSOTZKY and B. TARAMONKHINE (*Ann. Inst. Pasteur, 12 (1898), No. 8, pp. 501–509, pl. 1*).

Growth of anaerobic bacteria, TRENKMANN (*Centbl. Bakt. u. Par., 1. Abt., 23 (1898), No. 24, pp. 1038–1043; 25, pp. 1087–1090*).

On the simultaneous production of black, blue, green, and yellow pigments by a pyocyanic bacillus, CHARRIN and DE NITTIS (*Compt. Rend. Soc. Biol., 1898, July*).

Concerning proenzyms, E. DUCLAUX (*Ann. Inst. Pasteur, 12 (1898), No. 6, pp. 407–416*).—A critical review is given of the literature relating to proenzyms or prodiastases.

Concerning oxydase and the guaiac reaction, J. GRÜSS (*Ber. Deut. Bot. Gesell., 16 (1898), No. 5, pp. 129–139*).

A new thermo regulator, F. G. NOVY (*Jour. Appl. Micros., 1 (1898), No. 5, pp. 91, 92, figs. 2*).

Thermo-regulated water baths for the bacteriological laboratory, V. A. MOORE (*Jour. Appl. Micros., 1 (1898), No. 6, pp. 108, 109, figs. 2*).

ZOOLOGY.

The economic status of the mole, H. WILSON (*Pennsylvania Dept. Agr. Bul. 31, pp. 42, figs. 12*).—The bulletin contains a study of the life history, habits, etc., of the species of the mole family indigenous to Pennsylvania (*Scalops aquaticus*, *S. breweri*, and *Condylura cristata*), the economic relation of this family of mammalia to agriculture; and a tabulated statement intended to show the distribution of the mole throughout the State, this latter information being derived from correspondence.

The stomachs of 36 moles were examined. The data furnished by this examination show that the mole does not take vegetable matter into its stomach intentionally as food. The author believes that his conclusion that the mole is an insectivorous animal is substantiated by the dentation. The mole has abundant opportunity to obtain vegetable food, but with the exception of small quantities of such material it apparently subsists on insects and worms, which are more difficult to obtain.

"Its peculiar habit of burrowing among the roots of grasses and other plants, where it must often seize quickly prey liable to escape, will account satisfactorily for the presence of small fragments of vegetable tissue in its stomach.

"My conclusion, in final, is that, proving the mole to be an 'insectivorous' mammalian, is likewise proving its life work to be beneficial to the agriculturists, since of the vast amount of insect life taken as food by the mole, the larger part of it consists of insects whose whole existence is deleterious to plant life, they being vegetation eaters and destroyers; and that the annoyance caused by the mole by its burrowing under and disturbing the roots of growing plants while in quest of food is more than compensated by its destroying and removing therefrom the insect life feeding upon the vitality of these plants."

The author believes that the damage caused by the eating of grain seeds and fibrous roots, and the gnawing of roots of a tuberous nature, is due to the ravages of the mouse family (Arvicolinæ).

"As a matter of fact, the runways of the mole are taken possession of and occupied during the latter part of the summer and autumn season by the common brown 'field' or 'meadow' mouse (*Arvicola riparia*).

"This mouse, which undoubtedly does the most extensive damage to vegetation of any of our mammaliæ (being not only granivorous but herbivorous), makes its nest during the early part of the warm season on the surface of the ground in the middle of a luxuriant bunch of grass or other vegetation of a close and dense nature, from which home it makes its runways or paths in all directions (cutting and eating the vegetation clear for a width of from 1.5 to 2 in. in order to make these paths). When the vegetation is taken from the fields during the harvesting of crops, or so closely cropped by the grazing of the cattle as to offer but scanty hiding places from its natural enemies (the hawk and the owl, the fox and the skunk), this mouse takes up its habitation under brush piles, 'worm' fences, and rocks, or in stone piles and the underground runways of the mole. The latter it somewhat modifies for its own use and convenience by cutting openings thereinto every 2 or 3 ft. of length. The mouse, having thus become domiciled, follows the runways in all their ramifications, and as the mole in its search for food has driven these underground passages to those places where insect life is most prolific, amidst the densest vegetation, so the mouse, following thereafter, has supplied, with little trouble to itself, the vegetable food it so desires."

Although the author does not believe that moles cause damage by eating vegetable food, yet the fact is recognized that much annoyance may be caused by their "works" in lawns, flower beds, etc. A number of means of exterminating moles are mentioned. These include trapping, poisoning, and driving them away by placing such substances as mineral pitch, gas tar, or other materials of an unpleasant odor in their runways.

The distribution of moles in Pennsylvania is shown in some detail in tabular form.

Are vegetable substances found in the stomachs of moles? V. VRADI (*Selsk. Khoz. i Lyesor., 186 (1897), Aug., pp. 415–430*).—Contrary to the generally accepted view that moles feed exclusively on animal substances, the author found substances of vegetable origin in 17 out of 42 stomachs investigated.—P. FIREMAN.

Ornithology of North Carolina, J. W. P. SMITHWICK (*North Carolina Sta. Bul. 144, pp. 195–228, map 1*).—This is a list of the birds of North Carolina with notes on each species. The species listed number 303 and there are 22 which the author says should occur in the State since they are found in neighboring States.

Life zones in New Mexico, T. D. A. COCKERELL (*New Mexico Sta. Bul. 24, pp. 44*).—The bulletin aims to give a broad outline of the subject of the New Mexico life zones, with some illustrative details, fuller data to be published later. The main life zones recognized in New Mexico are the Treeless Zone, above the timber line; the Black Timber Zone, from about 10,000 feet elevation to the timber line; the Mid-alpine Zone, from about 8,000 to 10,000 feet elevation; and the Transition Zone, about 7,000 feet elevation.

Some notes on Nebraska birds, L. BRUNER (*Nebraska Hort. Soc. Rpt. 1896, pp. 48–179, figs. 51*).—The paper gives some general remarks on birds, the text of the Nebraska bird law, and a list of Nebraska birds, together with notes on their abundance, migrations, breeding, food habits, etc. Of the 780 species of North American birds 415 are recorded as visiting Nebraska, 227 as breeding and 100 as wintering in the State.

Report of the State zoologist, B. H. WARREN (*Pennsylvania Dept. of Agr. Bul. 34, pp. 83–90*).—Among other things it is noted that many of the birds and other animals for which bounties are offered are species that subsist largely on detrimental forms of animal life. The plan of offering bounties is not countenanced.

Investigations of the stomach of the English sparrow prove beyond all doubt that it feeds upon cereals, ripe fruits, and buds and blossoms of shade and fruit trees, and that the tender growth of the grape and other vines are especially attacked. It also destroys the young and the eggs of valuable insectivorous birds. Papers are noted on ravens, crows, jays, and shrikes, on skunks and their economic value, household pests, interesting facts concerning game, and miscellaneous natural history notes.

Report of the Commissioner [of Fish and Fisheries], 1896 (*U. S. Com. Fish and Fisheries Rpt. 1896, pp. 672, pls. 62*).—In addition to the report of the Commissioner, the volume contains Report on the propagation and distribution of food-fishes, by W. de C. Ravenel; Report upon the inquiry respecting food-fishes and the fishing grounds, by R. Rathbun; and Report of the division of statistics and methods of the fisheries by H. M. Smith. The appendix includes, among other articles, the following: Notes on the extension of the recorded range of certain fishes of the United States coasts, by H. M. Smith and W. C. Kendall; Notes on the food of four species of the cod family, by W. C. Kendall; Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George Sound, Florida, by F. Swift; List of the available publications of the Commission; Statistics of the fisheries of the interior waters of the United States, by H. M. Smith, and notes on the fisheries of the Pacific coast in 1895, by W. A. Wilcox.

Report of the Commissioner [of Fish and Fisheries], 1897 (*U. S. Com. Fish and Fisheries Rpt. 1897, pp. CLXXI + 340, pls. 80, figs. 36*).—The volume contains the report of the Commissioner; Report on the propagation and distribution of food-fishes, by W. de C. Ravenel; Report of the division of scientific inquiry, by H. M. Smith; Report of the division of statistics and methods of the fisheries, by H. M. Smith; and Report on the work of the *Albatross*, by J. F. Moser. The appendix contains "A manual of fish culture." (See below.)

A manual of fish culture, based on the methods of the United States Commission of Fish and Fisheries (*U. S. Com. Fish and Fisheries, 1897, pp. 340, pls. 80, figs. 36*).—The volume contains detailed directions for the culture of salmon, trout, bass, and other fresh-water and salt-water fish; also chapters on the American lobster, transportation of fish and fish eggs, spawning season, character of fish eggs, period of incubation, the edible frogs of the United States and their artificial cultivation, oyster culture, and clam culture.

METEOROLOGY—CLIMATOLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 26* (*1898*), *Nos. 4, pp. 139–193, charts 8: 5, pp. 195–240, fig. 1, charts 13; 6, pp. 241–290, charts 7*).—In addition to the usual meteorological summaries, No. 4 contains special articles on A visit to the highest meteorological station in the world, by R. de C. Ward; Seismic and oceanic noises, by S. W. Kain; Meteorological work in Alaska, by A. J. Henry; The international aeronautical conference, by A. L. Rotch; The eighth general meeting of the German Meteorological Society, by A. L. Rotch; Climatic data bearing upon the culture of the date palm, by A. J. Henry; Temperatures obtained by kites at Bergen Point, New Jersey, by H. L. Allen; Rainfall of Masaya and Granada, Nicaragua, by A. J. Henry; and notes by the editor on the rainfall and outflow of the Great Lakes, mountain stations in Australia, tin roofs as lightning conductors, temperature of lake water, meteorology of the second Wellmann expedition, notes from reports of the climate and crop sections, recent earthquakes, and lightning on the kite wire.

No. 5 contains special contributions on Moisture tables, by C. F. Marvin; The umbrella cloud, by W. D. Johnson; Voluntary meteorological and crop reporting stations, by F. J. Walz; and Observations in the Klondike, by U. G. Myers; and notes by the editor on convention at Omaha, evaporation and temperature, climatology, Blue Hill observatory, insurance against drought, the character of the evening, climate of Liberia, the rainfall and outflow of the Great Lakes, oceanic and seismic noises, electrical storms in Kansas, meteorological superstitions, frost formation and ice columns, prairie skies, a new gas in the atmosphere, notes from the reports of the climate and crop sections, and recent earthquakes.

No. 6 contains special contributions on A new method of observing the direction of movement of the atmosphere, by H. W. Clough; Kites within a thunder cloud, by T. Hovenden; Meteorological extremes at Northfield, Mass., by A. D. Elmer, Jr.; and Rainfall at Firmeza, near Santiago, Cuba, by J. Monroe; and notes by the editor on seasonal

forecasts in Oregon, meteorological observations in the Klondike, Weather Bureau service in Alaska, notes from the June reports of the climate and crop sections, a high rainbow, lightning on the kite wire, currents induced by distant lightning, new use for kites—the telephone kite, safety fuse for lightning on the anemometer, which trees attract lightning, tin roofs as lightning conductors, rain gushes and thunderstorms, the origin of atmospheric electricity, anomalous and sporadic auroras, moonshine and frost, waterspouts, periodic fluctuation of the Great Lakes, historic droughts in the United States, international balloon ascensions, June 8, 1898, the Smithsonian weather predictions, Broun's law of winds and currents, seasonal forecasts in India and America, earthquakes in New Brunswick, recent earthquakes, mathematics and meteorology, and meteorology by correspondence.

Climate of Cuba; also a note on the weather of Manila, W. F. R. PHILLIPS (*U. S. Dept. Agr., Weather Bureau Bul. 22, pp. 23*).—This is a brief compilation of all available data on temperature, rainfall, and other climatic features of the island of Cuba, with a brief note on weather conditions at Manila, in the Philippine Islands. For purposes of comparison the temperature, rainfall, and number of rainy days at Washington, D. C., and New Orleans, Louisiana, have been introduced in several of the tables.

"The average summer temperature (June, July, and August) of Habana is 82° F., that of New Orleans 81.6° F., and that of Washington 75° F. The highest temperature recorded in 10 years at Habana was 100.6° F., while at Washington the highest temperature has been 104° F. The average annual rainfall at Habana is 51.73 in., and is less than that at New Orleans, which is 60.52 in.; the rainfall at Washington is 44.70 in. . . . During [30 years] 5 occasions have happened when as much, or more, rain fell in the usual dry season as in the rainy season. The average amount of rain falling in the rainy season, which extends from May to October, is 32.37 in. In the same months the average rainfall for New Orleans is 27 in., and for Washington 24.10 in.

"[At Manila] the average temperature of the year is 80° F. The months of April, May, and June are the hottest part of the year. May, with an average temperature of 84° F., is the hottest of the three. December and January are the coolest months, each with an average temperature of 77° F. The highest thermometer reading recorded is 100° F.; this was observed in May. The lowest reading recorded is 74°, and was observed in January.

"The average relative humidity is 78 per cent. That of the most humid month, which is September, is 85 per cent, and that of the least humid month, which is April, is 70 per cent. The average absolute humidity is 8.75 grains in a cubic foot. It is greatest in August and least in February.

"The average annual rainfall is 75.43 in., of which 43.69 in., more than 57 per cent, fall during the months of July, August, and September, and 50.74 in., more than 80 per cent, fall from June to October, inclusive. September has the largest average fall, 15.01 in., and February the smallest average fall, 0.47 in. The heaviest rainfall in any one month was 61.43 in., in September, and sometimes no rain at all has fallen in February, March, April, and May.

"Departures from the average rainfall are in some instances remarkable. For example, as much as 120.98 in. have fallen in one year and as little as 35.65 in. in another. Still more remarkable was the fall of 61.43 in. in one September, and that of only 2 in. in another September."

The necessity of studying the haze, A. A. SCHULZ (*Rpt. Sci. Comm. Min. Agr. and Govt. Estates. St. Petersburg, 1897, pp. 12; abs. in Selsk. Khoz. i Lyesov., 187 (1897), Nov., p. 412*).—Among the meteorological factors unfavorable to vegetation the haze, which is often observed in eastern and southeastern Russia, is of considerable importance. Several opinions exist concerning the origin of this phenomenon, which acts very injuriously, especially on the ripening of cultivated plants. Some regard it as a result of the earth's storms; others believe it to be the smoke of forest and moor fires; still others consider it as a purely local phenomenon which may be induced by different causes (dust storms, evaporation from the soil, etc.). The question as to the real cause of this phenomenon, however, remains open because of insufficient study. In view of the importance of reaching a solution of this question the author recommends that observations on haze be made a part of regular meteorological observations and gives an outline plan of observations on this subject. It is stated that the Russian scientific bureau, acting upon the suggestion of the author of the report, has adopted measures for gathering more data on this subject.—F. FIREMAN.

Weather freaks of the West Indies, F. L. OSTWALD (*Pop. Sci. Mo., 53 (1898), No. 6, pp. 789–793*).—Popular notes on the nature and causes of the sudden hot and cold waves, droughts and cloud-bursts, and hurricanes, cyclones, and stifling calms which characterize the climate of the West Indies.

Investigation of the cyclonic circulation and the translatory movement of West Indian hurricanes, BENITO VIÑES (*U. S. Dept. Agr., Weather Bureau Doc. 168, pp. 34*).—This is a translation by C. Finley of an article prepared for presentation to the Meteorological Congress at Chicago in 1893, which the chief of the Weather Bureau regards "as the most satisfactory statement of the laws and phenomena of these storms which has yet been made."

The influence of vegetation on climate and rainfall, J. G. O. TEPPER (*Adelaide Observer, 1898, May*).

On the influence of forests on the occurrence of hail in European Russia, V. A. TARGONSKI (*Moscow: Society for Insurance of Crops Against Hail, 1898, pp. VI + 103, map 1; rev. in Selsk. Khoz. i Lyesov., 189 (1898), Apr., p. 224*).—The author concludes that the contour of the surface of the soil, its composition, and the distribution of forests are the chief invariable factors of hail phenomena.—P. FIREMAN.

Instructions for obtaining and tabulating records from recording instruments, C. F. MARVIN (*U. S. Dept. Agr., Weather Bureau Doc. 167, pp. 31, figs. 2*).—A manual designed especially for Weather Bureau observers.

Instructions for aerial observers, C. F. MARVIN (*U. S. Dept. Agr., Weather Bureau Doc. 166, pp. 33, pls. 3, figs. 14*).—A manual of instruction "for the guidance of aerial observers in the care and management of instruments and apparatus employed in making aerial observations with kites."

On an absolute actinometer, A. CROVA (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 20, pp. 1394–1398*).

On the rainfall, quantity of snow, and evaporation in the river basins of European Russia, E. A. HEINZ (*St. Petersburg, 1898, pp. 54+XXXIV; rev. in Selsk. Khoz. i Lyesov., 189 (1898), June, pp. 716, 717*).

Normal annual sunshine and snowfall, A. J. HENRY (*U. S. Dept. Agr., Weather Bureau Doc. 162, pp. 5, chart 1*).—The annual percentage of sunshine and the total annual snowfall by calendar years for each of the regular Weather Bureau and Canadian stations are shown in tables and in a colored chart. The amount of snowfall is given in inches as it lay on the ground.

Annals of the magnetic and meteorological observatory of the Imperial Novo-Russian University at Odessa, 1896, A. KLOSSOVSKI (*Odessa, 1897, pp. 85+CCLXXXV; abs. in Selsk. Khoz. i Lyesov., 188 (1898), Feb., p. 470*).

Meteorological observations, J. E. OSTRANDER and A. C. MONAHAN (*Massachusetts Hatch Sta. Met. Buls. 112, 113, and 114, pp. 4 each*).—These bulletins contain the usual weather notes and summaries of meteorological observations during the months of April, May, and June, 1898.

Monthly bulletins of the River and Flood Service for April, May, and June, 1898, P. MORRILL (*U. S. Dept. Agr., Weather Bureau Doc. 160, pp. 30, chart 1; 164, pp. 14, chart 1; 169, pp. 14, chart 1*).—In addition to the usual data, the April bulletin contains special reports on the saving of life and property in the lower Mississippi Valley as a result of Weather Bureau flood warnings during the spring of 1897.

Meteorological review. Report of the meteorological service of the southwest of Russia in 1896. Second ten-year period, I. A. KLOSSOVSKI (*Odessa, 1897, pp. 87; abs. in Selsk. Khoz. i Lyesov., 188 (1898), Feb., p. 469*).

Report of the Chief of the Weather Bureau, 1896–97 (*U. S. Dept. Agr., Weather Bureau Rpt. 1896–97, pp. X+431, pls. 61, charts 33*).—This report is divided into eight parts. Part I is an administrative report, which has already been noted (E. S. R., 9, p. 630). Part II gives a list of observing stations; hourly averages of atmospheric pressure, temperature, and wind from records of automatic instruments at 28 stations; average temperature and pressure in inches and thousandths for each hour of 75th meridian time; velocity and frequency of wind; and monthly mean values of pressure, temperature, and wind for the lustrum 1891–1895. Part III gives monthly and annual meteorological summaries for 142 Weather Bureau stations. Part IV gives monthly and annual means and extremes of temperature and dates of first and last killing frosts. Part V reports monthly and annual precipitation. Part VI gives miscellaneous meteorological tables, charts, and reports, including pressure distribution and prevailing winds, January and July; normal temperature; charts of sea-level temperature; monthly departures of temperature and precipitation in 1896 by geographic districts; cloudiness; relative humidity; sunshine, snowfall; descriptions of local storms and tornadoes; and the West India hurricane of September 29 and 30, 1896. Part VII is devoted to the amount, variation, and distribution of rainfall in the United States by seasons and by districts. Part VIII is a report on floods of the Mississippi River, which has already been noted (E. S. R., 9, p. 816).

WATER—SOILS.

A preliminary report on the soils of Florida, M. WHITNEY (*U. S. Dept. Agr., Division of Soils Bul. 13, pp. 31, pls. 6, figs. 3*).—The types of soils reported on are, first, second, and third quality high pine land; pine flats of the so-called "flat woods;" the light hammock, the gray or heavy hammock, mixed land, heavy marl hammock; pineapple land; Etonia scrub, the spruce-pine scrub; and the Lafayette formation.

"The principal localities and interests examined were the truck areas around Gainesville, Ocala, Orlando, Grand Island, Bartow, and Fort Meade; the tobacco areas of the Lafayette or 'red-land' formation at Quincy, as well as the new tobacco areas at Ocala, Bartow, and Fort Meade; the pineapple districts at Orlando, Winterhaven, and along the east coast from Fort Pierce to Palmbeach; also the extensive scrub lands at Altoona known as the Etonia scrub."

Four grades of pine lands are noted—pine flats or "flat woods," and first, second, and third quality of high pine lands. Of these the second quality of high-pine lands are the most extensive and important. These

soils are especially adapted to truck growing on account of the evenness of the water supply which they maintain. Four per cent of water seems to be an abundant supply, and 6 per cent makes the soil quite wet.

"Nearly every important variety of truck crops is grown upon these soils.

"Truck crops seldom suffer on these soils from drought. It is claimed that in one year a crop of tomatoes was secured with but 1 in. of rain from the planting to the harvesting of the crop. Certainly a dry period which would cause a most disastrous drought upon the soils at the North appears to have hardly any effect on the crops of these truck soils. Several weeks after a rain the soil immediately under the dry surface is so moist that it will hold together when molded in the hand."

The hammock lands are characterized by a native growth of hardwood trees, principally of oak, hickory, magnolia, dogwood, and the cabbage palmetto, and are considered the most valuable in the State for general agricultural purposes. They have proved especially valuable for the culture of tobacco. They maintain on the average about 8 per cent of water.

"[In order to secure the tobacco crop from injury by drought] a very thorough system of irrigation is being practiced on the hammock lands. It is claimed that the crop matures in from 45 to 50 days under judicious irrigation, against 60 to 70 days without irrigation. It is also claimed that it makes finer wrapper leaf.

"The irrigation outfit consists of an engine placed near a water course, with a capacity of about 1 horsepower per acre, and 1-in. or 1½-in. iron pipe laid near the surface of the ground for mains and laterals, the laterals being about 100 ft. apart, with hydrants every 50 ft. Tanks are frequently used, but it is considered preferable now to pump directly into the mains so as to insure sufficient pressure. Nozzles are used which give an even spray, and which are moved from hydrant to hydrant by an attendant as the work progresses. Such an irrigation plant for a field of 20 acres or over costs from $100 to $150 per acre. Where the hydrants are not sufficiently close to cover the ground with spray a hose is used with a movable spray to water the space between the laterals.

"Very recently the method of shading, which has been used with great success in the pineapple fields, has been adopted in connection with the tobacco."

On the Etonia scrub lands there is a dense growth of scrub oaks and low bushes and plants. No grass is found, and only the most hardy desert plants grow. The border line between these soils and the high pine land, on which the trees are large and vigorous and the ground covered with grass, is sharply defined. "There is no apparent reason, from the chemical or physical examination, to account for this difference in the native growth," on the two kinds of land.

Pineapples are grown extensively on the high pine lands. On these the soil is a coarse, almost pure white sand, apparently devoid of plant food. The subsoil is either a coarse white or yellow sand. As regards physical condition, as well as chemical composition, these soils appear to be absolutely unsuited to agricultural purposes. Nevertheless, with proper fertilizing, shading, and irrigating they have proved very valuable for the production of pineapples.

The soils of the Lafayette formation in western Florida are fine, light, sandy loams, resting upon what appears to be a strong clay subsoil of considerable depth. The loam soil contains about 5 per cent of clay,

the subsoil upward of 30 per cent. However, these soils contain only about 8 or 10 per cent of water as compared with 18 to 22 per cent maintained by similar soils in Pennsylvania and Ohio.

A comparison of the mechanical analyses of different Florida soils shows a great similarity in composition and texture. The percentage of clay is, as a rule, very low. No difference was found in the texture of these soils which would in any way explain the differences in their natural vegetation and agricultural value. Chemical examination and determination of the soluble salt content in the different types of soil showed that not only is there a small amount of plant food present in the soil, but that only about 1 per cent of it is present in soluble form.

"These results all seem to show that these types of Florida soil constitute a distinct class of soils, unlike the average soils of the humid portions of the United States."

Determinations of moisture in these different soils show that their moisture supply is very uniform, and that a much lower percentage of water suffices for natural vegetation and for different cultivated crops on these soils than on similar soils in other regions. Thus, it was found that the hammock soil maintains on an average only 8 to 9 per cent of moisture, and that this is amply sufficient for the growth of oaks and other hard-wood trees, while at least 15 or 20 per cent of water is necessary for oaks and similar hard-wood trees on soils in the North. Moisture determinations in the scrub and adjacent high pine land showed no apparent difference in the moisture content of these 2 soils during the dry season.

Detailed analyses of the different samples of soils and subsoils are given in tables.

The bluff and Mississippi alluvial lands of Louisiana, W. W. CLENDENIN (*Louisiana Stas. Special Rpt. Geology and Agriculture, pt. 4, pp. 259–290*).—This is a continuation of the geological and agricultural survey of Louisiana which has been prosecuted for a number of years (E. S. R., 8, p. 382). In the preceding report (pt. 3), brief consideration was given to the bluff lands of east and southwest Louisiana. The present report is confined to "a preliminary study of the border lands of the Mississippi River which are directly the product of the river itself." These are comprised within "a somewhat irregular zone stretching over about 4° of latitude and varying in width from about 15 miles at the Arkansas line to about 100 miles from the line of Five Islands on the southwest to Tickfaw River on the northeast." The bluff lands east of the Mississippi cover an area of about 1,000 square miles. Those bordering the alluvium of the west are of "such an irregular and indeterminable extent that it is difficult to estimate the amount in square miles." The topography, drainage, mineral products, and vegetation of these soils are briefly noted.

The alluvial soils are classified as (1) front lands, (2) back lands, (3) swamp, and (4) deep swamp. The front lands are the border lands of

the Mississippi and all of its bayous. They are made up of sandy soils on which the characteristic vegetation is the live oak. The soils of the back lands are finer in grain, and contain more clay than those of the front lands. The clay breaks up under cultivation into small rounded masses, which have given the name "buckshot" to these soils. These 2 classes of soils constitute at present the cultivated portion of the Mississippi alluvium. It is difficult to obtain a sufficient supply of good water in this region. It is suggested that the difficulty may be overcome, at least in part, by the sinking of artesian wells.

"As the front lands grade into the back lands, so these grade into the swamp. The areas thus designated, while not so easily drained as the back lands, are nevertheless capable of thorough drainage. They are considered as swamp and useless for cultivation only because under conditions that have existed in the past they have been too frequently overflowed to make their clearing and cultivation profitable. Under a system of protection that will shut out the flood waters from the master streams they will become available for cultivation. At present they are not so.

"Their tree growth consists chiefly of sweet and black with some tupelo gum, large and abundant; abundant ash of sufficient size and quality to make it valuable for manufactures; scaly-bark hickory; elm; red maple; white, water, and willow oaks; sycamore; and cypress. The undergrowth, while still dense, is marked by a failing of the cane. At present these swamp lands are chiefly valuable for their supplies of hard-wood lumber. Their adaptation to cultivable uses, while possible, must wait upon their greater security from inundation.

"The deep swamp area, chiefly valuable for its forests of cypress and gum, is subject to too deep and too frequent inundation ever to be used for cultivation; at any rate, not until more available lands prove insufficient for the increased population."

Attention is called to the large number of navigable streams in this region, and suggestions are made regarding protection against overflow. Although the soils of the region have been heretofore considered valuable chiefly for the production of cotton, recent experiments have shown that they are capable of producing a superior grade of cigar-wrapper tobacco. The bluff lands also produce sugar cane with an unusually high sugar content. The famous Perique tobacco is grown on the alluvial lands of this region, and they have also been shown to be preeminently suited to alfalfa. Near New Orleans, market gardening on the alluvial soils has proven very profitable, and in the extreme southern part of the region orange culture has brought good returns. The adaptability of the waters of the region to fish and oysters and the rapid development of oyster culture in the coastal bayous and bays are pointed out. The results of the examinations of the soils of the region are reserved for a future report.

The fertility of Oregon soils, G. W. SHAW (*Oregon Sta. Bul. 50, pp. 56, pl. 1*).—This is a continuation of work previously reported in Bulletin 21 of the station (E. S. R., 4, p. 464). A general discussion is given of the importance of chemical analysis of soils, origin of soils, functions of soils, constituents of soils and their functions, and texture of soils. The natural divisions of the State are described, and analyses, including determinations of coarse material, fine earth, water capacity,

hygroscopic moisture, organic matter, humus, and mineral constituents of 71 samples of soils from the different sections of the State are reported. The averages for the main divisions of the State, as well as for the State as a whole, are given in the following table:

Average composition of Oregon soils.

Analysis of fine earth.	Willamette Valley.	Southern Oregon.	Eastern Oregon.	Average for whole State.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Insoluble matter	65.18	62.45	66.59	65.08
Soluble silica	5.02	8.74	13.12	7.69
Potassium oxid	.23	.34	.43	.32
Sodium oxid	.18	.21	.22	.29
Calcium oxid	.83	2.22	1.22	.97
Magnesium oxid	.79	.80	.75	.82
Mangano-manganic oxid	.08	.25	.10	.16
Ferric oxid Aluminium oxid	16.45	15.35	10.69	12.68
Sulphuric acid	.03	.01	.04	.70
Phosphoric acid	.21	.13	.14	.26
Water and organic matter	10.77	9.52	6.21	10.05
Total	99.77	100.02	99.51	99.02
Humus	1.63	2.25	1.44	2.42

The bottom lands of the Willamette Valley as a rule "have a tendency toward clay loams with clay subsoils forming a hardpan." The soils are divided into dark loam and gray loam, the latter running into the so-called "white lands." They are all, however, of about the same chemical composition. They are rich in phosphoric acid and humus, well supplied with lime, but deficient in potash.

"That these soils should be fairly well supplied with lime would be expected from *a priori* reasons on account of the basaltic origin of a large part of them. The lime in the valley soils is not altogether in the form of a carbonate—indeed, it is rare that sufficient carbonate is present to cause evident effervescence with acid—but even a casual examination shows a very common occurrence of easily decomposable zeolites, principally mesolite, from which, by weathering, the lime may be constantly supplied."

In the hill country surrounding the Willamette Valley, in its northern part, are found the so-called "shot lands," which contain considerable amounts of iron oxid, together with quartz, feldspar, and some hornblende, the iron oxid cementing the particles of clay together into small nodules which to some extent resemble shot, but which wear away in cultivation. These soils are usually well drained and easily worked, but wash badly in heavy rains. They contain as a rule a fair amount of potash, a limited amount of lime, and are well supplied with phosphoric acid.

The soils of southern Oregon "are stronger than the Willamette Valley soils not only in lime but also in potash, but weaker in phosphoric acid." The soils of eastern Oregon contain more lime than those of the humid or western area. They also contain a larger supply of potash, which is more available than that in the soils of the Willamette Valley. The amount of phosphoric acid, however, is smaller than that of the western soils.

The influence of climate upon the lime content and humus of the soils of these different regions is discussed, as well as the origin and treatment of alkali in the western or arid portion of the State and the adaptability of the various soils to different systems of farming.

The importance of the mineral humates as a nutritive medium for plants, G. NEFEDOV (*Selsk. Khoz. i Lyesor., 187 (1897), Jan., pp. 141–163*).—The question which the author seeks to answer is whether the phosphorus and nitrogen which enter into the composition of the humus compounds of the chernozem (black Russian soil) are assimilable by the higher plants under the ordinary conditions of cultivation, i. e., in the presence of micro-organisms.

The experiments carried out consisted in the first place of a repetition of the experiments of Eggertz with a soil washed with a dilute mineral acid, precautions being taken to carefully neutralize the soil after this treatment, and in the second place in growing plants in humus substances extracted from the chernozem, inoculating the humus extract with the bacteria of the soil. In order to neutralize the soil after treatment with the acid and distilled water the free humic acids were saturated with calcium carbonate.

The experiments were made with the chernozem of the Tula Government. The composition of the air-dried soil was as follows:

Analysis of air-dried chernozem.

	Per cent.
Hygroscopic water	5.97
Humus with water of crystallization	10.16
Phosphoric acid obtained by igniting the soil and treatment with boiling 30 per cent hydrochloric acid	.1702
Nitrogen	.377
Air-dried humic acid (calculated to ash-free matter)	4.87

In the humus there was found 1.88 per cent of phosphoric acid, which represents 51.6 per cent of all the phosphoric acid of the soil.

In the repetition of Eggertz's experiments part of the soil was treated with 1 per cent hydrochloric acid and part with 3 per cent. After washing with distilled water a small portion was at once dried on filter paper, while the greater part was first mixed with chalk, using 100 gm. of chemically pure carbonate to 200 gm. of the air-dried soil. Before placing in the glass cylinders where the plants were grown the various soil samples were pulverized and mixed with different nutritive solutions.

The material for the experiments with the pure calcium humates was prepared as follows: The soil was treated with 1 per cent hydrochloric acid, washed with distilled water, dried on filter paper, pulverized, and placed in layers 1 cm. thick in tin sieves whose bottoms were covered on the inside with a layer of filter paper. The soil was treated with ammonia solution (1 part of strong ammonia and 3 parts of water), the solvent remaining in contact with the soil for from 15 to 30 minutes, and then the soil was washed with distilled water. The black extract

fell drop by drop into a $\frac{1}{2}$ to 1 per cent solution of hydrochloric acid, where it was precipitated in flakes and settled at the bottom of the vessel. The humic acid was transferred to a folded filter and washed first with 0.25 to 0.5 per cent hydrochloric acid and then with distilled water. The washed humic acid was mixed first with chalk and then with white quartz sand, which had been treated with aqua regia and washed with distilled water.

Three series of experiments were carried out, (1) with soil treated with 3 per cent hydrochloric acid in 13 pots planted to barley, oats, lupines, and peas; (2) with soil treated with a 1 per cent solution of hydrochloric acid in 4 pots planted to barley, and (3) with calcium humate in 8 pots planted to barley and peas.

The chief results obtained may be summed up as follows:

(1) The chernozem soil treated with a 3 per cent solution of hydrochloric acid and inoculated with the micro-organisms of the soil contains easily assimilable nitrogen and phosphorus in quantities sufficient for the formation of the vegetative organs of barley.

(2) Calcium humate containing no mineral admixtures may be obtained by mixing gelatinous humic acid with calcium carbonate, which is decomposed under these conditions with the evolution of carbon dioxid.

(3) The humic acids extracted from the chernozem by successive treatment with acid and alkali, even when in the form of calcium salts, disturb the regular development of plants, causing an intensified formation of shoots and rendering impossible the formation of the reproductive organs.

(4) Potassium phosphate renders the poisonous properties of the artificially obtained calcium humates more marked.

(5) The poisonous action of the calcium humates is probably due to the presence of ferrous oxid in the humus substances formed by the reduction of the ferric oxid during the process of the extraction of the humic acids.

(6) The opinion of Hoppe-Seyler that the humus substances are unalterable under the ordinary conditions of the soil and in no measure serve as food for the lower organisms is erroneous. The humus substances extracted from the chernozem by chemical means either in soluble form or insoluble form, when acid in reaction as well as when feebly alkaline or neutral, in the presence as well as in the absence of air, are a very suitable nutritive medium for the growth of the lower organisms.

(7) The phosphorus and, apparently, the nitrogen of calcium humate in the presence of the micro-organisms of the soil contribute to the growth of the higher plants (barley).—P. FIREMAN.

Review of the literature of soils, L. OCHAPOVSKI (*Selsk. Khoz. i Lyesor., 190 (1898), July, pp. 147–186*).

Soil bacteria in their relation to agriculture, I, F. D. CHESTER (*Delaware Sta. Bul. 40, pp. 16, figs. 2*).—This is a popular summary of information on this subject.

The topics treated are the elements and sources of plant food, the nature and origin of soils, the number and distribution of soil bacteria, and the chemical changes produced by bacteria.

FERTILIZERS.

Contribution to the solution of the question of the extent to which the potash requirements of soil can be determined by analysis of the plant and the soil, O. LEMMERMANN (*Landw. Vers. Stat.*, *49* (*1897*), *Nos. 1-5*, *pp. 287-339*).—Both field and pot experiments on this subject are reported. Experiments in the field were made on unfertilized soils and those which had received kainit at rates of 1,000 to 2,000 kg. per hectare (about 890 and 1,780 lbs. per acre). The crops grown were oats, wheat, and rye. The potash content of the soils was determined by digesting 200 gm. with 400 cc. of 10 per cent hydrochloric acid on a boiling water bath for 3 hours. The attempt was made first to determine what amount of potash soluble in this reagent is necessary in a soil in order to produce normal crops. It was found in these experiments that a soil containing 0.24 per cent of potash soluble in 10 per cent hydrochloric acid was not improved for the production of oats by applications of potassic fertilizers, although the yield of wheat and rye on such soils was considerably increased by applications of such fertilizers. No relation was observed between the amount of potash in the soil and that found in the plant. Samples of soil were treated with $\frac{1}{16}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, and 5 per cent hydrochloric acid, the soil so treated being used in pots for the growth of oats. The object in this case was to determine the exact strength of acid and method of treatment which would remove all of the potash assimilable by oats. The experiments, however, gave negative results because the oats grew best in the soils which had been exhausted with the stronger acid. The author believes this to be due to chemical changes which render the potash not dissolved by the acid more accessible to the roots of the plants and at the same time more assimilable. Contrary to the results obtained in the field, the potash content of oats grown in pots increased with the amount of this substance applied to the soil.

The liming of soils, H. J. WHEELER (*U. S. Dept. Agr. Farmer's Bul. 77*, *pp. 19*).—This bulletin discusses the use of lime for improving soils, its manurial and chemical action, its physical effects, and its effects on the action of microscopic organisms in the soil. The conditions under which lime may be injurious are pointed out. The influence of lime upon some plant diseases is noted and directions for the application of lime to soils are given. Fifteen forms of lime used for agricultural purposes are described.

"There are many soils in which lime is deficient, notably in soils derived from granite, mica schist, and sandstone formations. On such soils lime is of direct value in supplying a necessary element of plant food.

"The indirect value of lime is perhaps more important than its direct action, because probably the majority of cultivated soils contain sufficient lime to meet the direct demands of plants. Lime is of indirect value in unlocking the unavailable potash, phosphoric acid, and nitrogen in the soil.

"Lime exerts a decided influence on the mechanical condition of soils, rendering heavy, compact soils looser in texture and tending to bind particles of loose leachy soils.

"Lime is also beneficial in furnishing conditions in the soil favorable to the activity of the micro-organisms which convert the nitrogen of organic matter into nitrates which are readily assimilated by plants, which decompose organic matter, and which assist leguminous plants to assimilate the free nitrogen of the air. . . .

"The continued use of lime unaccompanied by other fertilizers may prove injurious, especially on poor soils, since it converts the insoluble nitrogen, potash, and phosphoric-acid compounds of the soil into forms which are rapidly taken up by plants or washed out in the drainage, and thus hastens the exhaustion of the supply of these substances in the soil. If the soil is not abundantly supplied with organic matter, its retentive power for water and fertilizers may be seriously reduced on account of the destruction of the organic matter by the action of too much lime. Soils are sometimes injured by applications of impure forms of lime, which harden like cement in the soil, or of those which contain an excessive amount of magnesia.

"It has been shown that even many upland and naturally well-drained soils apparently in good condition otherwise are so sour (acid) that most plants will not thrive on them. The application of caustic lime is the most economical and effective means of correcting this condition.

"According to experiments made by the Rhode Island Experiment Station on acid soils in that State, the plants tested may be classified with regard to their behavior toward lime as follows: Plants benefited by liming—spinach, lettuce, beets (all kinds), gumbo (okra), salsify (vegetable oyster), celery, onion, parsnip, cauliflower, cucumber, eggplant, cantaloupe, asparagus, kohl-rabi, cabbage, dandelion, Swedish turnip, pepper, pea, peanut, martynia, tobacco, sorghum, alfalfa, clover, barley, wheat, oats, timothy, and Kentucky bluegrass; plants injured by liming—serradella, watermelon, blue lupine, and common sorrel (*Rumex acetosella*); plants indifferent to liming—Indian corn, common millet, Hungarian, golden millet, rye, potatoes, carrots, Rhode Island bent (grass), and redtop (grass)."

Commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Bul. 75, pp. 77-94*).—This bulletin gives the text of the amended State fertilizer law, which went into effect March 14, 1898, with a brief discussion of the amendments; and tabulated analyses and valuations of 102 samples of fertilizing materials inspected during 1898.

"The new law requires manufacturers to make affidavit to the director [of the experiment station] guaranteeing the minimum analysis of each brand of fertilizer which they propose to sell in the State, and the director shall print this guaranteed analysis over his facsimile signature in the form of a tag, and every package of fertilizer sold or offered for sale in the State shall have one of these tags attached, and this tag analysis shall be the standard by which the fertilizer is to be judged. The tag shall also show the net weight of fertilizer contained in each package. The manufacturer also sends to the director a fair sample of each kind of fertilizer which he proposes to put on sale. The director is given authority to take samples for analysis from any fertilizer on sale in the State, and is required to make every year at least one analysis of each kind of fertilizer that has been entered for sale. The law also provides that any purchaser of a fertilizer, who is not an agent or dealer, may take a sample of the same, under proper regulations, and have it analyzed at the station free, and such purchaser shall not be required to give the name of the fertilizer or of the person from whom it was bought until after the analysis has been made and reported. But after the purchaser has received the report of analysis he must give the director all information about the fertilizer that may be required for publication

in the station bulletins or for prosecution of the case if it appear that the law has been violated.

"Under the new law the estimated value per ton is not given on the tag. It was thought best to leave it off for two reasons—first, because the ingredients of which fertilizers are made vary in price from time to time during the year, and as the tags are good for a year, or until used, the estimated value might not represent anywhere near the true valuation during a portion of the year, at least; and, second, because it is much more important that the farmer should buy on the percentage of phosphoric acid, nitrogen, and potash in the fertilizer than on the estimated value."

The phosphate deposits of Arkansas, J. C. Branner (*Trans. Amer. Inst. Min. Eng., 26, pp. 580–598; abs. in Tech. Quart., 11 (1898), No. 2, Rev. Chem., p. 51*).—A detailed account of unworked deposits. Analyses of the phosphatic nodules show from 22.62 to 33.86 per cent of phosphoric acid.

Fertilizer inspection, C. D. Woods, J. M. Bartlett, et al. (*Maine Sta. Bul. 43, pp. 8*).—This bulletin contains the analyses of 125 manufacturers' samples of fertilizers licensed before February 25, 1898, with a brief summary of the chief provisions of the State fertilizer law.

The cost of plant food in Connecticut, spring months of 1898 (*Connecticut State Sta. Bul. 127, pp. 10*).—This bulletin contains a schedule of trade values of fertilizing ingredients for 1898; notes on the purchase of fertilizers and on the cost of nitrogen in nitrate of soda, sulphate of ammonia, dried blood, cotton-seed meal, and castor pomace; phosphoric acid in dissolved boneblack and acid phosphate, and potash in high-grade sulphate, double sulphate of potash and magnesia, muriate of potash, carbonate of potash, and cotton-hull ashes; and analyses of 7 samples of fertilizing materials, including mixed fertilizers, bat guano, rape-seed meal, and street sweepings. Determinations of the solubility of the organic nitrogen of 5 of the fertilizers in pepsin solution are also reported.

Analyses of commercial fertilizers, T. J. Edge and W. Frear (*Pennsylvania Dept. Agr. Bul. 37, pp. 40*).—This bulletin gives the text of the State fertilizer law, notes on valuation, and tabulated analyses and valuations of 591 samples of fertilizing materials inspected during the period from January 1 to August 1, 1898.

Analyses of commercial fertilizers, M. A. Scovell, A. M. Peter, and H. E. Curtis (*Kentucky Sta. Bul. 71, pp. 115–123*).—This bulletin gives the trade values of the essential fertilizing ingredients for 1898, which are the same as those for 1897, and tabulated analyses and valuations of 34 samples of fertilizers examined since the publication of Bulletin 68 of the station (E. S. R., 9, p. 338).

FIELD CROPS.

Experiments with different kinds of fertilizers in 1896 on the Kazan Experimental Farm (*Selsk. Khoz. i Lyesov., 185 (1897), May, pp. 263–282*).—Experiments were made with rye, oats, potatoes, and clover with timothy for hay.

Rye.—Three series of experiments were made with rye. The object of the first series was to study the influence on the yield of rye of the following fertilizers: (1) Barnyard manure 35,600 lbs. per acre, (2) barnyard manure with 416 lbs. of superphosphate, (3) green manure, (4) green manure with 416 pounds of phosphate, (5) green manure with 416 lbs. of potash, (6) green manure with 356 lbs. of Berliner's bone meal A (4.5 per cent of nitrogen and 24 per cent of phosphoric acid), and (7) green manure with 178 lbs. of Berliner's bone meal B (0.6 per cent of nitrogen and 31 per cent of phosphoric acid). The plats, 0.45 acres each, were sown in 1890 under clover with timothy. The tabu-

lated results show that green manure with phosphate gave a decrease of 12.9 per cent, with potash 2.6 per cent; and green manure alone gave an increase of 5.3 per cent, green manure with bone meal A 6.25 per cent, green manure with bone meal B 7.4 per cent, barnyard manure with superphosphate 27.7 per cent, and barnyard manure alone 50.9 per cent.

In the second series of experiments with rye the influence of the following fertilizers was studied: (1) Superphosphate 416 lbs. per acre, (2) nitrate of soda 416 lbs., (3) Berliner's bone meal A 356 lbs., and (4) Berliner's bone meal B 178 lbs. The tabulated results show an increase of the yield in all cases: For bone meal B 11 per cent, bone meal A 35 per cent, nitrate of soda 35 per cent, and superphosphate 49.6 per cent.

The third series of experiments was designed to study the influence of phosphate and potash as compared with that of manure. Potash was applied at the rate of 416 lbs., and phosphate at the rate of 370 lbs. per acre. The results were as follows: Phosphate gave a decrease of 9 per cent, while potash gave an increase of 0.82 per cent, and manure an increase of 16.8 per cent.

Oats.—The object of the first series of experiments with oats was to investigate the action of the following fertilizers on the yield of oats: (1) Bone meal A 356 lbs. per acre, (2) bone meal B 178 lbs., and (3) nitrate of soda 416 lbs. The results show that nitrate of soda gave a decrease of 30 per cent and bone meal a decrease of 4.4 per cent, while bone meal B gave an increase of 7 per cent.

The second series was carried out on the plats which had been used the preceding year for experiments with rye similar to those of the first noted above. The following fertilizers had been applied the preceding year: (1) Manure alone 35,600 lbs. per acre, (2) manure with 416 lbs. of superphosphate, (3) superphosphate 416 lbs.; and (4) nitrate of soda 416 lbs. The results were as follows: Nitrate of soda gave an increase of 2.5 per cent (the increase of rye the preceding year was 37.2 per cent), superphosphate 5.3 per cent (rye preceding year 2.3 per cent), manure 24.8 per cent (rye preceding year 18.5 per cent), and manure and superphosphate 27 per cent (rye preceding year 12.8 per cent).

The third series of experiments with oats was made on the same plats devoted the preceding year to experiments with rye similar to those of series 2 noted above, the object being to ascertain the influence of the fertilizers under rye on the succeeding oats. The following fertilizers were used: (1) Green manure with 416 lbs. of phosphate, (2) green manure with 416 lbs. of potash, and (3) green manure alone. Green manure alone gave a decrease of 0.28 per cent and green manure with phosphate and potash a decrease of 0.72 per cent; while the preceding year the increase in the first case was 19.5 per cent and in the second case 57.5 per cent.

Experiments were also made on plats on which rye was grown the preceding year with the following fertilizers: (1) Manure 35,600 lbs. per

acre, (2) phosphate 370 lbs. The phosphate, which in the preceding experiments with rye gave an increase of 7.6 per cent, in these experiments yielded 5.1 per cent increase; the manure gave in these experiments 19.4 per cent increase, in the preceding experiments 13.5 per cent increase.

Potatoes.—In the first series of experiments with potatoes the object was to investigate the influence of bone meal, applied both broadcast and in hills, and of nitrate of soda and potash. The following amounts were used: (1) Bone meal A 356 lbs. per acre broadcast, (2) bone meal B 178 lbs. broadcast, (3) potash 267 lbs., (4) nitrate of soda 267 lbs., (5) bone meal A 356 lbs. in hills, and (6) bone meal B 178 lbs in hills. The potato leaves were affected by rot (*Phytophthora infestans*). All fertilizers gave an increase—potash 3.5; bone meal B broadcast 18.2, in hills 39.8; bone meal A broadcast 20.3, in hills 44.3; and nitrate of soda 55.4 per cent. The greater the yield the less the starch content of the potatoes. Potash alone caused a very slight increase in the yield, but decreased the starch content 0.15 per cent.

In the second series of experiments the influence of double plowing and of planting at a depth of 10.5 to 12.2 in. was investigated. Experiments were also made in which the seed potatoes were soaked for 24 hours in a 2½ per cent solution of copper sulphate, with a view to ascertaining whether this treatment prevents rot and exerts any influence on the yield. The double plowing produced an increase of 6.2 per cent; the treatment with copper sulphate caused a decrease of 9.9 per cent. The starch content was not changed by the double plowing, but the treatment with copper sulphate resulted in a decrease of 1.3 per cent in starch content.

The object of the third series of experiments was to ascertain the influence of spraying the potato leaves with various liquids on the yield and starch content. The following solutions were applied: (1) Limewater, (2) pure water, (3) copper sulphate and limewater, (4) copper sulphate. While spraying with pure water gave an increase of 2.6 per cent and with limewater of 10.8 per cent, spraying with copper sulphate alone caused a decrease of 4.1 per cent and with copper sulphate and limewater a decrease of 0.45 per cent. The starch content decreased with limewater (0.6 per cent), but increased with pure water (0.5 per cent), with copper sulphate alone (0.6 per cent), and with copper sulphate and limewater (1 per cent).

Clover with timothy for hay.—The object of the first series of experiments with these crops was to observe the influence of kainit, nitrate of soda, gypsum, and phosphate-gypsum on the yield of clover with timothy at the first mowing of the first year. Fertilizers were applied as follows: 370 lbs. per acre of kainit and 250 lbs. per acre of the other fertilizing materials. Kainit gave 1.7 per cent, phosphate-gypsum 10.4 per cent, and gypsum 5.9 per cent decrease, and only nitrate of soda gave an increase in yield (6.5 per cent).

The object of the second series of experiments was the same as the first, but was confined to the second and third mowings. In all cases there was an increase, which for the second mowing was 21.5 per cent with nitrate of soda, 17.5 with kainit, 45.6 with phosphate-gypsum, and 21.9 with gypsum alone; and for the third mowing 31 per cent with nitrate of soda, 23.4 with kainit, 34.3 with phosphate-gypsum, and 6 with gypsum.

In the third series of experiments an attempt was made to ascertain to what extent oats as a cover plant decreases the yield of clover with timothy. The yield of hay was 84.9 per cent less with the cover than without it.—P. FIREMAN.

Experiments with field crops, 1897, G. E. MORROW and J. H. BONE (*Oklahoma Sta. Bul. 33, pp. 18, figs. 3*).—Experiments were made with corn, oats, cotton, Kafir corn, millo maize, Jerusalem corn, sweet sorghum, castor beans, sugar beets, stock or "pie" melons, alfalfa, cowpeas, soy beans, grasses, and clovers. Popular notes are given on these crops and the results of experiments are tabulated. Kafir corn planted April 17 and May 1 gave an average yield per acre of 22.3 bu. of grain, while plats planted May 15 and 22 yielded 38.2 bu. The amount of stover produced per pound of grain was 6.1 and 3.4 lbs., respectively. The largest yield of grain (53.3 bu. per acre) was obtained from the plat on which stalks were 3 in. apart in rows 3 ft. apart. In general the plats with the greatest number of stalks gave the largest yield of stover.

A comparison of Indian corn and Kafir corn showed that Kafir corn was much more drought-resisting, but that it grew much less rapidly.

Oats were sown at different rates, but the yields varied little. Of the 9 varieties grown the best yielding were Texas Red, Negro Wonder, Lincoln, and Black Russian in the order given.

Castor beans planted April 13 yielded 12.9 bu. per acre, which was a better yield than was obtained from later plantings.

Report of the agriculturist, J. H. SHEPPERD (*North Dakota Sta. Rpt. 1897, pp. 51–79*).—The work here described is in continuation of that reported a year ago (E. S. R., 9, p. 741). The continuation of the variety testing of wheat, oats, barley, and corn did not change the relative rank of the best-yielding varieties reported last year.

Red Kafir corn, white Kafir corn, millo maize, durra, and Jerusalem corn, tested for 4 years, have failed to ripen fully during any season. The results of cultivation experiments are given in abstract form from a former bulletin (E. S. R., 9, p. 931). Awnless brome grass (*Bromus inermis*) has given promising results for a number of years. Timothy and clover sown with this grass were crowded out by its vigorous growth. "It should be seeded at the rate of 20 lbs. per acre without a nurse crop." A field of timothy and red clover injured by heavy rains yielded about $1\frac{1}{4}$ tons of hay per acre. The results of a rotation experiment are given in the following table:

Yield per acre in rotation experiment.

	Average for 1893 and 1897.	1893.	1894.	1895.	1896.	1897.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Wheat continuously, average for six plats	12.1	9.4	19.6	23.3	16	14.8
First, second, and third wheat crops after barren fallow, average for four plats	17.3	15.3	24	24.9	....	21.3
First, second, and third wheat crops after cultivated crops: corn, peas, rape, potatoes, and mangels, average for six plats	18.4	16.5	24.8	23.3	....	20.2
First, second, and third crops of wheat after millet, one plat	16.8	13.3	23.8	23	....	20.3
First, second, and third crops of wheat after timothy and clover for two years, one plat	....	....	....	31	20.5	21.6
First crop of wheat after flax for one year, average for one plat	....	....	....	23.3	....	19.5
Second crop of wheat after flax for one year, one plat	....	....	....	....	19.2	....
First crop of wheat after flax for three years, one plat	....	....	....	....	....	22
Flax continuously for three years, one plat	....	....	9.5	12.6	12.6	....
First and second wheat crops after flax followed by fallow, one plat	....	....	14.5	25	....	....
First, second, and third wheat crops after field peas, one plat	17.4	14.4	23.5	23	....	20.4
First, second, and third wheat crops after green manuring with field peas, one plat	11.7	10.4	23.5	23	....	12.9
First, second, and third wheat crops after manuring with millet, one plat	15.6	14.1	22.8	23.5	....	17
First crop of wheat after potatoes, one plat	....	....	....	....	....	16.8

Wheat was grown after corn and millet on manured and unmanured plats. The results showed a marked increase in yield from the application of manure.

A study of the castor-oil plant, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 32, pp. 11–15*).—The amounts of nitrogen, phosphoric acid, and potash removed from the soils by the different parts of the castor-oil plant were determined and the results are tabulated. Analyses were made of 3 varieties—2 common varieties, the seed of which had been obtained from Oklahoma and Kansas, and 1 ornamental variety. The proportion of beans and hulls for the 3 varieties was approximately 75 per cent of hulled beans and 25 per cent of hulls. The beans were found to contain about 60 per cent of oil. Directions are given for the determination of castor oil in beans. The fertilizing constituents in the different parts of the plant were found to be as follows:

Amount of principal fertilizing elements in the castor-oil plant.

Part of plant.	In one plant.			In 100 parts fresh substance.		
	Nitrogen.	Potash.	Phosphoric acid.	Nitrogen.	Potash.	Phosphoric acid.
Common variety.	*Grams.*	*Grams.*	*Grams.*	*Per cent.*	*Per cent.*	*Per cent.*
Stalks and roots	2.30	3.55	0.49	0.26	0.40	0.06
Leaves	6.06	5.12	.84	1.64	1.39	.23
Beans	10.27	2.40	4.10	3.45	.48	1.38
Pods	3.99	14.06	.43	1.63	5.75	.18
Entire plant	22.62	25.13	5.86	1.24	1.38	.32
Ornamental variety.						
Stalks and roots	3.12	3.22	.50	.31	.32	.05
Leaves	4.86	3.35	.62	1.71	1.18	.22
Beans	10.95	1.65	4.53	3.58	.54	1.48
Pods	6.29	14.58	.83	2.82	6.54	.37
Entire plant	25.22	22.80	6.48	1.39	1.25	.36

"One thousand pounds of castor beans contain 35 lbs. nitrogen, 4 lbs. potash, and 14 lbs. phosphoric acid. The pods gathered with this amount of beans weigh approximately 800 lbs. and contain 13 lbs. nitrogen, 46 lbs. potash, and 1½ lbs. phosphoric acid."

Cotton and corn experiments, 1897, B. C. PITTUCK (*Texas Sta. Bul. 45, pp. 977-1008, pls. 5*).—The experiments comprised variety and distance tests with cotton and fertilizer tests with cotton and corn. A description of the soil and climate, chemical and mechanical analyses of the soil, and meteorological data for the entire year are given. The results of the experiments are tabulated, and the results of variety tests with cotton and corn in 1894 and 1895 are summarized. The results of the cotton and corn experiments made in 1894 (E. S. R., 7, pp. 114, 115) are appended in abstract form.

The variety and distance experiments with cotton were made with 5 varieties planted at different distances. The following table shows the comparison of distances of planting and the yields of varieties:

Yield of varieties of cotton at different distances.

Variety.	Group No. 1. 3 by 2 ft. rows.		Group No. 2. 4 by 2 ft. rows.		Group No. 3. 4 by 3 ft. rows.	
	Seed lint.	Lint.	Seed lint.	Lint.	Seed lint.	Lint.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Bohemian (check)	970.3	321.3	667.5	218.4	681.3	208.1
Jones Improved	693.7	217.6	681.9	204.5	862.6	273.2
Welborn Pet	728.2	237.2	690.9	218.7	708.9	217.2
Peterkin. L. C	806.8	294.2	712.3	219.1	643.0	201.4
Texas Oak	546.5	204.9	613.9	213.5	537.8	184.8

Bohemian, Texas Oak, and Jones Improved gave the largest yield in groups 1, 2, and 3, respectively.

Nitrogenous, phosphatic, and potassic fertilizers were applied to cotton singly and combined. Plats which received boneblack, cottonseed meal, or cotton-hull ashes at the rate of 500 lbs. per acre produced the best yields of those receiving single applications. Of the complete fertilizers, the application of 200 lbs. acid phosphate and 4,000 lbs. barnyard manure per acre gave the best yield. The best results in the entire test were obtained from the application of 500 lbs. boneblack per acre.

In the fertilizer test with corn, the largest yield followed the application of 500 lbs. per acre of acid phosphate. Of the nitrogenous fertilizers, barnyard manure at the rate of 4,000 lbs. per acre, and of the potash fertilizers, cotton-hull ashes at the rate of 500 lbs. per acre. gave the best yields. Of the complete fertilizers, the application of 100 lbs. kainit, 400 lbs. acid phosphate, and 150 lbs. muriate of potash per acre gave the best results.

Report upon the grasses and forage plants of central Texas, H. L. BENTLEY (*U. S. Dept. Agr., Division of Agrostology Bul. 10, pp. 38, figs. 14*).—This bulletin discusses the early conditions of the ranches of

central Texas and the reasons for their deterioration, and suggests methods for their renewal. Notes are given on the grasses and forage plants mentioned.

The following native grasses and forage plants are recommended for propagation:

Western wheat grass (*Agropyron spicatum*), feather sedge or feather blue stem (*Andropogon saccharoides torreyanus*), bushy blue stem (*A. nutans*), side-oats grama (*Bouteloua curtipendula*), black grama (*B. hirsuta*), blue grama (*B. oligostachya*), rescue or artic grass (*Bromus unioloides*), Arizona millet (*Chætochloa macrostachya*), Bermuda (*Cynodon dactylon*), wild rye (*Elymus canadensis*), everlasting grass (*Eriochloa punctata*), curly mesquite (*Hilaria cenchroides*), wild timothy (*Muhlenbergia racemosa*), white top (*Triodia albescens*), galleta or black grama (*Hilaria mutica*), alkali saccaton (*Panicum bulbosum*), barnyard grass (*P. crus-galli*), beardless barnyard grass (*P. crus-galli muticum*), cotton-top (*P. lachnanthum*), chaparral millet (*P. reverchoni*), hurrah grass (*P. reticulatum*), Colorado or Concho grass (*P. texanum*), switch grass (*P. virgatum*), water grass (*Paspalum pubiflorum glabrum*), Texas crow-foot (*Leptochloa dubia*), drop seed (*Sporobolus cryptandrus*), needle or dog-town grass (*Aristida fasciculata*), and buffalo grass (*Bulbilis dactyloides*).

In addition to the above the following are considered of probable value:

Bur grass (*Cenchrus tribuloides*), wild millet (*Chætochloa italica*), sedges (*Cyperus* and *Carex* spp.), bog rushes (*Juncus* sp.), satin grass (*Muhlenbergia tenuiflora*), grape-vine mesquite (*Panicum obtusum*), crab grass (*P. sanguinale*), knot grass (*Paspalum distichum*), wild oats (*Uniola latifolia*), prairie sage brush (*Artemisia ludoviciana*) butterfly pea (*Clitoria mariana*), bushy knotweed (*Polygonum ramosissimum*), woolly plantain (*Plantago gnaphalioides*), purslane (*Portulaca oleracea*), and cotton purslane (*P. pilosa*).

The following grasses and forage plants are thought to be of little forage value, but worthy of consideration:

Crow's foot (*Chloris cucullata*), feather crow-foot (*C. alba*), love grass (*Eragrostis pilosa* and *E. secundiflora*), stink or candy grass (*E. major*), *Muhlenbergia arenicola*, old witch or tickle grass (*Panicum capillare*), hairy-flowered panic (*P. ciliatissimum*), brown top (*P. fuscum*), Hall grass (*P. hallii*), *Sporobolus drummondii*, fall redtop (*Triodia seslerioides*), gunaninpil (*Allionia incarnata*), tumble weed (*Amaranthus blitoides*), water purslane (*Ammannia coccinea*), white sage, sage brush (*Artemisia mexicana*), ground plum (*Astragalus crassicarpus*), fox sedge (*Carex vulpinoidea*), star thistle (*Centaurea americana*), lamb's quarters (*Chenopodium album*), grandpa's beard (*Clematis drummondii*), wild sages (*Croton* spp.), red-root sedge (*Cyperus erythrorhizos*), hog nut, chufa (*C. esculentus*), *Ephedra nevadensis*, alfilaria (*Erodium cicutarium*), winter fat (*Eurotia lanata*), rosin weed or gum weed (*Grindelia squarrosa*), dwarf broom weed (*Gutierrezia sarothræ microcephala*), sunflower (*Helianthus annuus*), artichoke (*H. tuberosus*), blue weed (*Hoffmanseggia stricta*), wild verbena (*Lippia nodiflora*), bur clover or California clover (*Medicago maculata*), prickly pear (*Opuntia engelmanni*), sorrel (*Oxalis corniculata*), prairie clover (*Kuhnistera* sp.), and the mesquite bean (*Prosopis juliflora*).

Experiments with oats, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 74, pp. 195–211*).—These experiments were along similar lines to others heretofore reported (E. S. R., 9, p. 42). The results are given in tabular form.

In a comparison of spring-plowed, fall-plowed, and unplowed land

for oats, the best yields for 5 years in succession were obtained from the spring-plowed land. The average yield was 27.4 bu. per acre, or about 2 bu. more than was obtained from the fall-plowed or unplowed land.

In experiments carried on for 5 years the best yields were obtained from oats sown the first or second week in March. These plants also grew taller and had larger panicles than those from later seedings.

Light, common, and heavy oats were used for seed. The common grain was the grain as it came from the thresher. The average yields for 8 years were 27.5, 28.89, and 30.9 bu. per acre, respectively.

Trials with different methods of seeding were carried on for 7 years. The seed was sown broadcast and with a hoe drill, a shoe drill with press wheels, and a shoe drill without press wheels. The average yields were 26.24, 28.34, 30, and 31.54 bu. per acre, respectively.

The average results for 7 years from different rates of seeding were as follows: One bushel of seed per acre yielded 24.65 bu.; 1½ bu., 27.87 bu.; 2 bu., 29.12 bu.; 2½ bu., 30.86 bu.; 3 bu., 30.43 bu.; 3½ bu., 30.43 bu.; 4 bu., 32.79 bu.

Land subsoiled in the fall of 1895 yielded 52.56 bu. of oats per acre, while unsubsoiled land yielded 53.17 bu. "Subsoiling has almost invariably decreased the yield of wheat, corn, and oats on the college farm."

Fall-plowed and spring-plowed land was packed with Campbell's subsurface packer previous to seeding. Fall-plowed land packed once yielded at the rate of 29.37 bu., and the plats packed 3 times yielded at the rate of 29.34 bu. per acre. The unpacked fall-plowed land yielded 25.49 bu. per acre. Spring-plowed land packed once yielded at the rate of 27.87 bu. per acre, and plats packed 3 times yielded at the rate of 29.37 bu. per acre. Unpacked spring-plowed land yielded 22.24 bu. per acre.

Among the varieties tested for 7 years the so-called red varieties, such as Pedigreed Red Rust Proof, Red Rust Proof, and Red Georgia, have given the most satisfactory results in general.

With the use of "Ceres Pulver" the percentage of smut was reduced from 19.03 to 5.38.

Potatoes: Tests with fertilizers, M. A. SCOVELL (*Kentucky Sta. Bul. 72, pp. 1–9, pl. 1*).—Fertilizer tests were made on tenth-acre plats with nitrate of soda, acid phosphate, and muriate of potash applied singly, in twos, and the 3 substances together. Nitrate of soda and muriate of potash were applied at the rate of 160 lbs. per acre, and acid phosphate at the rate of 140 lbs. These amounts furnished 25.6 lbs. of nitrogen, 80 pounds of potash, and 57 lbs. phosphoric acid. Nitrate of soda and acid phosphate applied singly resulted in loss as compared with the check plats which received no fertilizer. The use of potash alone greatly increased the yield. Acid phosphate and muriate of potash applied together resulted in the best yield (109.6 bu.

per acre), while on the plat which received the application of the 3 fertilizing substances a yield of 109.4 bu. was obtained.

Sorghum: Its development as a commercial source of sugar, C. L. PENNY (*Delaware Sta. Bul. 39, pp. 23, dgms. 3*).—The work of propagation commenced in 1894 was continued in 1897. Fields of sorghum were grown for the station on 2 private farms—at Cape Charles, Virginia, and Harbeson, Delaware. At the first place the varieties McLean and Amber were grown, and on the other farm the same 2 varieties with Colman and Frame New in addition. The stalks at different cuttings were sent to the station for analysis and the determination of other data. During the season more than 2,800 stalks were examined individually. The results are tabulated and discussed at considerable length.

In 1897 the percentage of sugar in the juice of Frame New ranged from 6.31 to 15.93 and averaged 11.98; that of Colman ranged from 10.16 to 17.84 and averaged 14.62; that of McLean grown at Harbeson ranged from 10.71 to 17.35 and averaged 15.20; the same variety grown at Cape Charles ranged from 6.69 to 19.05 and averaged 15.24; the Amber grown at Harbeson ranged from 8.30 to 19.19 and averaged 15.74; and the same variety grown at Cape Charles ranged from 10.09 to 20.50 and averaged 18.15.

A formula for calculating the quantity of sugar which can be manufactured from a ton of cane is worked out, which is as follows: "If the percentage of sugar in the juice be diminished by 0.9 per cent and the remainder be multiplied by the coefficient of purity, regarded as a fraction, the product will express the pounds of pure sugar actually to be crystallized from 100 lbs. of stripped and topped cane."

The results of experiments with sorghum at the station and at other stations are summarized in a table.

"There has been within the period of 10 years, from 1888 to 1897, an undoubted improvement in the cane, so that within that time the same variety, so called, has varied more than have different varieties at the same time. There must, of course, be differences of season and of soil more or less favoring or hindering a good crop, yet despite these there has been an unquestionable rise in the quality of the cane, and this must be attributed to judicious selection of seed for propagation."

A diagram is given showing the probable amount of sugar which can be crystallized from a ton of stripped and topped cane of Amber, McLean, and mixed crops grown under different conditions, indicating that "the several varieties, when compared on the basis of yield of crystallized sugar, show much greater differences than on the basis of sugar content. While on the latter basis the extremes are about as 3 to 1, on the former they are about as 5½ to 1. This, as has been explained, is due to the fact that the proportion of sugar crystallized varies approximately as the purity of the juice, and, secondly, that the purity usually rises and falls with the sugar content."

The selection of seed for propagation, and the various factors which

are to be taken into account in the improvement of sorghum for sugar-making purposes are discussed at some length.

"The question of interval of planting as affecting tonnage per acre, and possibly as affecting in less degree sugar content, calls most urgently for thorough study. It is impossible to know without extensive and intelligently planned experiments exactly what may be expected as the maximum yield of both cane and of sugar. Estimates may be based on what has been done, but with cane as far improved as are these present crops over certain former ones, new experiments specially directed to this end must give valuable and much needed information."

Sugar beets, J. T. WILLARD (*Kansas Sta. Bul. 78, pp. 65-80*).—This is a report on the cooperative culture experiments with sugar beets in 1897. Two hundred pounds of seed was distributed to 393 farmers and of these 156 sent samples for examination. The results of analyses are tabulated. The beet-sugar industry in its relation to the State is discussed, and directions given for growing sugar beets.

The average results deduced from the samples analyzed were as follows: Gross weight per beet, 1.51 lbs.; net weight, 1.09 lbs.; specific gravity of juice, 1.064; total solids in the juice, 15.52 per cent; sugar in the juice, 11.88 per cent; coefficient of purity, 76.1.

Sugar-beet investigations in 1897, A. D. SELBY and L. M. BLOOMFIELD (*Ohio Sta. Bul. 90, pp. 123-162, maps 6*).—This bulletin contains a detailed tabulation of cooperative culture experiments with the sugar beet in 1897. Maps are given showing the average rainfall and the average isotherms of the State for 15 years for June, July, and August; for these 3 months and September combined; and for September alone. Suggestions concerning beet-sugar factories and cultural methods are noted. The average results of analyses for the entire State show a sugar content of 14 per cent in the juice and a coefficient of purity of 78.7. It was found that in general the sugar content and purity of samples taken at different dates increased as the season advanced. Beets grown on clay soils were richer in sugar than beets grown in black loam or sandy soils. Samples grown on muck lands were especially poor in quality.

Wyoming sugar beets, E. E. SLOSSON and B. C. BUFFUM (*Wyoming Sta Bul. 36, pp. 189-205*).—In this bulletin the results of experiments in sugar-beet culture for the years 1891 to 1897, inclusive, are reported in tables. The earlier experiments were made by the station on 5 experimental farms located in different parts of the State, and the later ones by a number of farmers throughout the State. The average results obtained on the experimental farms are given in the following table:

Comparative table showing results of sugar-beet culture on the experiment farms from 1891 to 1897, inclusive.

Experiment farm.	Average yield per acre.	Average sugar content of beets.	Average purity.
	Tons.	*Per cent.*	
Lander	19.24	15.25	81.01
Laramie	5.09	13.26	75.50
Sheridan	13.25	18.36	83.93
Sundance	4.50	14.76	75.34
Wheatland	9.61	17.85	85.20

"The region about Sundance, when irrigation is not possible, and the elevated plateau . . . represented by Laramie, do not give satisfactory results. . . .

"According to our experience, the alkali in this State, which consists chiefly of sodium and magnesium sulphate, does not interfere with the growth of the beets or perceptibly impair their quality. Good crops of satisfactory richness have many times been grown in ground strongly impregnated with soluble salts, and in 1897 an experiment bearing directly on this point was carried out."

The results were as follows:

Sugar beets grown on alkali and ordinary soils.

	Yield per acre.	Sugar content of beets.	Purity.
	Tons.	*Per cent.*	
Alkali land	7.2	19.0	89.2
Good land, subsoiled	6.4	19.7	88.2
Good land, not subsoiled	5.8	20.3	92.7

The sugar-beet industry is discussed in general and notes given on the method of cultivation.

Cane, sirup, and sugar, H. E. STOCKBRIDGE (*Florida Sta. Bul. 44, pp. 47, pl. 1, figs. 4*).—This is a popular discussion of sugar-cane culture and the manufacture of sirup and sugar from cane. The following subjects are considered in short notes: Soil conditions, preparation of the land, fertilizing the crop, planting the cane, cultivating, harvesting, and preserving seed cane.

Analyses were made of 3 varieties of cane on different dates to test the effect of the time of harvesting upon the yield of sugar. The results are shown in the following table:

Sugar content of cane on different dates.

	Cut Nov. 20.	Cut Nov. 30.	Cut Dec. 10.
	Per cent.	*Per cent.*	*Per cent.*
Red cane	14.22	15.34	15.60
Green cane	10.10	11.41	15.15
Ribbon cane		10.34	12.36

From a consideration of the relative profits from sirup making and sugar making the conclusion is drawn that sugar cane "is more profita-

ble when converted into sirup than when manufactured into sugar; still the combination of the two is commendable, at least to the extent of supplying home demand. . . . The sugar-cane crop on a purely commercial basis can be made one of the most profitable resources of the Florida farmer, aside from the mere advantage of domestic independence." The manufacture of sirup on the farm and the use of Spanish moss for clarifying are described.

Practical chemistry of soils and crops, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 32, pp. 1-10*).—General suggestions on crops and soils, giving the amount of the elements of fertility removed from the soil by crops of wheat, oats, corn, Kafir corn, cotton, and castor beans.

Fertilizer experiments and variety tests with barley, C. KRAUS and G. LUFF (*Fühling's Landw. Ztg., 47 (1898), No. 13, pp. 487-493*).

The culture of winter barley (*Deut. Landw. Presse, 25 (1898), No. 59, p. 656*).—Notes on the culture and harvesting of winter barley.

Practical notes on growing and harvesting barley for brewing purposes, A. EMMERLING (*Landw. Wchnbl. Schleswig-Holstein, 48 (1898), No. 29, pp. 502-504*).

Malting barley (*Queensland Agr. Jour., 2 (1898), No. 6, pp. 440-443*).—Hints on the successful cultivation of barley for malting purposes.

The black Mauritius bean, A. H. BENSON (*Queensland Agr. Jour., 3 (1898), No. 2, pp. 151, 152, pls. 2*).—A short description of the plant and notes on the preparation of the soil, method of planting, and use of the crop are given. This legume is closely related to the velvet bean.

Crimson clover, F. E. EMERY (*North Carolina Sta. Bul. 145, pp. 231-247*).—A discussion of the experiments with crimson clover at the station and the cooperative experiments carried on throughout the State. A digestion experiment with feeding crimson clover hay to a goat and a sheep is reported. Notes are given on the dangers of feeding overripe crimson clover hay and on the introduction of crimson clover into the State.

Medicago maculata and M. denticulata for fodder and green manuring, F. SPIEGEL (*Deut. Landw. Presse, 25 (1898), No. 45, p. 494*).—The value of these legumes is briefly mentioned and the method of treating the seed before sowing described.

Brabant clover, H. BICHEL (*Landmansblade, 31 (1898), No. 4, pp. 38-40; Märkfrökontaret 25 Aasber., 1897, pp. 18-20*).—This clover, an annual, originated in Brabant, Holland, and is there grown mainly for soiling purposes. There are two varieties, one small seeded, the other large seeded, differing in the size of the seed and herbage. The large-seeded variety produces the heavier yields of fodder. This variety has been grown in Denmark in an experimental way and has given promising results.

A variety test of cotton, 1893, F. E. EMERY (*North Carolina Sta. Bul. 146, pp. 254-258*).—Fourteen varieties, including the Egyptian varieties Afifi and Bamia, were tested. The highest percentage of lint was obtained from Peterkin, King No. 1, and Shine Early Prolific, which varieties, with King No. 2, also produced the largest yields of lint.

A small variety test of cowpeas, F. E. EMERY (*North Carolina Sta. Bul. 146, pp. 251, 252*).—Six varieties of cowpeas were tested. The Black cowpea ripened earliest and the Unknown variety produced the largest yield of dry peas. The peas were planted July 3, and on September 22 the Black variety had ripened and its leaves fallen.

Growing grass and other forage crops for seed (*Braunschw. Landw. Ztg., 66 (1898), No. 33, pp. 139, 140*).

Notes on the seeding of grass land, W. T. HALL (*Agr. Students' Gaz., n. ser., 9 (1898), No. 1, pp. 4-8*).—A report on the percentage of different grasses in pastures 4 and 5 years after seeding them down.

Setaria and its culture, P. MIKHYEYEV (*Selsk. Khoz. i Lyesor., 185 (1897), May, pp. 343-380*).

Harvesting lupines and oil-yielding crops, J. KÜHN (*Deut. Landw. Presse, 25 (1898), No. 56, pp. 623, 624*).—A discussion of the methods of harvesting lupines and crops of rape and beets grown for the seed.

Oil-yielding crops and lupines, H. LEHNERT (*Deut. Landw. Presse, 25 (1898), No. 75, p. 804*).—The methods of culture and harvesting are briefly noted.

Culture and use of white mustard (Sinapis alba) (*Deut. Landw. Presse, 25 (1898), No. 66, p. 723*).

Growing winter barley, J. H. MANSHOLT (*Deut. Landw. Presse, 25 (1898), No. 65, p. 711*).—Notes on cultivating and harvesting winter barley.

Culture experiments with winter oats, SCHACHT (*Deut. Landw. Presse, 25 (1898), No. 64, p. 704*).—A discussion of results of experiments with English varieties of winter oats. The varieties are not yet adapted to the climatic conditions of Germany.

Some experiments with potatoes, F. E. EMERY (*North Carolina Sta. Bul. 146, pp. 258-263*).—Comparisons were made of deep and shallow culture, early and late planting, and different rates of seeding. Deep planting with level culture yielded 30.25 bu. more per acre than shallow planting with hilled culture; the early-planted plat yielded at the rate of 108.4 bu. more per acre than the late-planted plat; and seeding at the rate of 24 bu. per acre resulted in better yields than seeding at the rate of 12 and 18 bu. per acre.

Planting potatoes and their fertilizer requirements, M. FISCHER (*Fühling's Landw. Ztg., 47 (1898), No. 9, pp. 350-356*).—A discussion of experiments.

Wheat testing—description of mill, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 9 (1898), pt. 7, pp. 713-716, pl. 1*).—A description of a mill for testing small samples of wheat. The advantages of the mill in testing the milling qualities of wheat from experimental plats and in judging wheats are pointed out.

Test of effect of chemical manure and cotton-seed meal on the germination of wheat, F. E. EMERY (*North Carolina Sta. Bul. 146, pp. 252-254*).—To a number of wheat plats chemical manures and cotton-seed meal were applied at the time of sowing the grain. On some plats the cotton-seed meal was worked into the soil before sowing and on others it was put on top of the covered rows. The results indicated that cotton-seed meal under the wheat injuriously affected its growth. "It is believed that the oily character of the meal interferes materially with the rising of water in the soil by capillarity" and that in this way an application of cotton-seed meal, especially when but recently made, interferes with germination and growth.

Heine bearded squarehead wheat (*Deut. Landw. Presse, 25 (1898), No. 75, p. 807, fig. 1*).—A description of the variety and its history are given.

Relations between the color of the grain, the composition, and the form of the heads and stems of rye, M. FISCHER (*Fühling's Landw. Ztg., 47 (1898), No. 13, pp. 504-517, pls. 4*).—The results of experiments in breeding rye are discussed with reference to the transmission of the above-mentioned factors.

The lodging of grain, L. LEHMANN (*Deut. Landw. Presse, 25 (1898), No. 64, p. 705*).—Notes on methods which tend to prevent the lodging of grain.

Storage of grain, O. BÖHM (*Die Kornhäuser. Stuttgart: J. H. Cotta's Successor, 1898*).—A study of the organization of the grain trade in America, India, Russia, and Germany, with special reference to the systems of storing grain in the different countries.

Plants best adapted for litter, F. G. STEBLER (*Die besten Streuepflanzen. Bern: K. J. Wysz, 1898*).

Experiments in tobacco culture in 1895 and 1896, N. PASSERINI (*Atti R. Accad. Econ. Agr. Georg. Firenze, 4. ser., 21 (1898), No. 1, pp. 43-59*).—The experiments consisted of fertilizer and variety tests with tobacco. The varieties tested were Kentucky Burley, Seed Leaf, Havana, Sumatra, Brazilian Exotic, Virginia Bright, Aya-Soluk, Malacca, and Singapore. The results are tabulated and discussed in detail.

Cooperative experiments made by the Ohio Agricultural Students' Union in 1896, L. M. BLOOMFIELD and J. S. HINE (*Ohio Sta. Bul. 88, pp. 69-97*).—This bulletin describes the purpose of the organization, outlines the plan of the experiments, and reports the results of various experiments with corn and potatoes. The results of fertilizer tests are tabulated and the manner in which the experiments were conducted is described. The results of experiments with corrosive sublimate and flowers of sulphur for the prevention of potato scab, and of variety and culture tests with potatoes are reported.

HORTICULTURE.

Asparagus, F. W. CARD (*Nebraska Farmer, 26 (1898), No. 25, p. 551*).—The author reports the results of experiments with asparagus at the Nebraska Station. Salt as a fertilizer was found to have no beneficial effect and to be injurious when used in considerable quantities. Deep setting of asparagus is briefly discussed and the arguments usually given in favor of it are noted. To test the matter, 100 plants each of Donald Elmira and Palmetto varieties were set in 1894, one-half of each variety being placed from 8 to 10 in. deep and one-half from 3 to 4 in. deep. The results are given as follows: "The first difference to appear between these depths of planting was the influence upon earliness. Those plants set shallow appeared decidedly in advance of the ones planted deep, and this difference was not only evident the first year but has continued in succeeding years. Later in the season comparatively little difference in the vigor of the plants was observed, if any difference existing being in favor of the shallow-set plants."

Growing melons in the North, F. W. RANE (*New Hampshire Sta. Bul. 52, pp. 49-70, figs. 6*).—Suggestions concerning the culture of muskmelons in New Hampshire are given and a test of 72 varieties is reported. The data are given in tables accompanied by descriptive notes. The fruits of the different varieties are illustrated. The characteristics of the varieties as compiled from various catalogues are given in tabular form. The small-sized varieties proved more productive than the larger ones. The varieties having the best flavor were as follows: *Small*—Captain, No. 88, Newport, Golden Netted Gem, Earliest Ripe, Rose Gem, Jenny Lind, Shippers' Delight; *medium*—Perfected Delmonico, Pineapple, Extra Early Cantaloupe, Satisfaction, Skillman Fine-netted, Improved Jenny, Jersey Belle, Ivy Gem, Banquet, Market, Netted Nutmeg; *large*—Sill Hybrid, Tip Top, Ironclad, Miller Cream, Delmonico, Long Island Beauty, Six Oaks Cantaloupe, Surprise; *extra large*—Lone Star, Long Yellow, Triumph.

Tomatoes, J. S. ROBINSON (*Maryland Sta. Bul. 54, pp. 117-134*).—The bulletin reports variety tests of tomatoes and experiments in the use of Bordeaux mixture for tomato-leaf blight. In 1896, 20 plants each of 30 varieties, and in 1897, 12 plants each of 19 varieties were grown. One-half of the plants of each variety were sprayed with Bordeaux mixture, the other half being left unsprayed. The first year the plants

were sprayed 4 times and the next year 3 times. Tables are given showing the dates of picking, the weight of fruit at each picking, and the computed yield per acre for both the sprayed and unsprayed plants of each variety.

In regard to varieties the author says: "The varieties giving the largest early yields are Early Ruby, Potato Leaf, Prize Taker, Autocrat, and Canada Victor. The best varieties for main crop trucking are Paragon, Prize Taker, Perfection, World's Fair, and Climax. The best varieties for the canning trade are Royal Red, Queen, Stone, Paragon, and Matchless. The best variety for late market or family use is the Buckeye State." The first 4 sprayings increased the yield of ripe fruit of all but one variety in 1896 and of all but 3 varieties in 1897, and, taking account of the green fruit at the end of the season, spraying increased the yield in every case. In 1896 the average yield of the sprayed plants was at the rate of 9.52 tons per acre and of unsprayed plants 6.98 tons per acre. In 1897 yields of sprayed and unsprayed plants were at the rate of 10.26 and 8.11 tons per acre, respectively. It was found that infection of the blight may take place through the agency of insects. Some Colorado potato beetles that were feeding on blighted potatoes were placed on isolated and protected tomato plants, other plants being kept as checks. The plants on which the beetles were placed blighted, while the check plants showed no evidence of the disease.

Miscellaneous fruit notes, S. C. MASON and W. L. HALL (*Kansas Sta. Bul. 73, pp. 181–193*).—Notes are given on 20 of Munson's hybrid grapes. In summarizing the notes the author says:

> "All the Post Oak hybrids are tender in our climate and need winter covering. All are vigorous growers except the Triumph hybrid, and all are late in blooming and in ripening of fruit. Blood, Sweetey, and Letoney give us a delicious juice for canning, and doubtless would make a fine wine; Carman is a very fair table grape; Texas Highland is a better, but does not bear well. . . .
>
> "From this brief glance at all of these hybrids we may fairly infer, it seems to me, that the pistillate parent exercises a stronger control over the character of the vine than does the pollen-bearing parent, while the predominating influence of the male (or pollen-bearing) parent can most often be detected in the fruit; and further, that the strong tendency toward tenderness from a *Vitis vinifera* cross is not escaped in the third generation."

Tests of the Mariana plum indicated that it can be used with good results as a stock for grafting the varieties of American, Japanese, and European plums. Apricots grafted on the Mariana stock made a vigorous growth, but there was an almost total lack of continuity in grain of wood of stock and scion. A longitudinal section of a 6-in. tree trunk showed a sharply drawn line rising a little from the center to the outside. "Toward this line of separation the wood grain from each side made a sharp curve inward, becoming parallel with it. A section $\frac{1}{4}$ in. in thickness was readily broken with slight pressure, breaking sharply on this line across the entire section, except a small portion at the center."

A test of the relative value of peach and Myrobalan plums as stocks for peaches resulted decidedly in favor of the peach stocks. The trees grafted on plum stocks were not as strong growers as the others, began early to show signs of failing, and had trunks with decided enlargements just above the stock.

Notes are given on a number of Russian fruits, none of which are recommended for growth in Kansas.

Dendrolene applied to the trunks of peach trees for about a foot just above the ground damaged the trees in all cases, some of the trees being killed.

In germinating a quantity of peach pits it was noticed that a number of them contained 2 embryos, 2 seedlings forming instead of 1. These seedlings were fruited for 3 years and observed closely to determine whether the 2 trees from one pit would differ from each other as much as seedlings ordinarily do. The author says:

"Of the distinctness of each tree as a variety there can be no question, the trees of some pairs being more distinct from each other than from trees in other pairs. In other cases the 2 trees were so nearly alike as to call for an inspection of minute details of leaf and gland in order to distinguish them. The resemblance to the variety from which the seed was produced was very marked, and especially in the case of the seedlings from Hale Early."

Varieties of pears and peaches, G. COOTE (*Oregon Sta. Bul. 52, pp. 8–16, figs. 9*).—Descriptive notes are given on several varieties of pears, with outline drawings of the fruits of each.

Notes are given on the leaf curl of peaches (*Exoascus deformans*). To determine whether the disease was caused by climatic changes, badly affected trees of 3 varieties were transplanted in the fall of 1893 to half-barrels in a greenhouse, the temperature of which did not fall below freezing. The trees were placed outdoors during the following summer. They grew well and showed no signs of disease. The next fall the trees were returned to the greenhouse. The following season they were perfectly healthy and blossomed and fruited well. Buds from diseased trees from the orchard were set in healthy greenhouse trees. The buds grew well, only the first leaves being affected. In the next fall the trees were planted in the orchard and the following spring were very severely attacked by the disease. For preventing leaf curl the author believes that a mixture of lime, sulphur, and salt, used to spray the trees just before the buds open, is beneficial.

Flower seed growing in America, W. W. TRACY (*Gardening, 6 (1898), No. 136, pp. 243, 244*).—In discussing the improvement of the sweet pea in America the author says: "The Extra Early Blanch Ferry was not the result of the selections of the earliest flowers, but it was developed on the theory that the time (from the sowing of the seed) of the plant coming into flower was quite as largely affected by conditions of growth as by constitutional tendency, but that the period in the development of the plant when it first showed bloom was more a matter of constitutional tendency than of growth conditions. Accordingly, in

breeding for early flowering, plants which produced flowers from the lowest nodes rather than those which first showed flowers were selected, and the results showed the correctness of the theory. It seems to me that what Americans have done in the development of this flower suggests possibilities with others and that we ought to look forward to the production of our own flower seeds of all kinds."

Adherence to type of seed breeding, W. W. TRACY (*Gardening, 6 (1898), No. 138, pp. 282, 283*).—The author notes some of his experience in breeding vegetables and flowers to illustrate the value of first forming an ideal and of then adhering to it strictly. He says: "The highest quality and most practically valuable seed of a variety is not that which from a large planting will produce a few superlative plants but that from which the largest proportion of the entire product will be of fine type. Uniformity of product is really the most important object of seed breeding, and to secure it we must have first a clear conception of just what in every particular an ideal plant of the variety should be, and secondly we must adhere rigidly to that ideal in our selection of breeders from year to year, and that we may do so it is essential that we have on record a full, minute, and accurate description of the ideal plant we are working to produce and select such plants and such only for breeders, rejecting those that differ from the ideal in any way even if the difference is of itself an improvement. . . . An intimate acquaintance with most of the stocks of vegetable and flower seeds in common use convinces me that the greatest horticultural need of the age is clearly defined ideas of just what ideal plants of the different varieties propagated by seed should be and a closer adherence by seed growers to such ideals in selecting stock."

Report of horticultural department, C. B. WALDRON (*North Dakota Sta. Rpt. 1897, pp. 25; 26*).—Experiments with celery and cauliflower are outlined. No results were secured on account of destruction of the plants by cutworms. A destructive disease of raspberries is noted.

Marketing fruit, M. CRAIG (*Oregon Sta. Bul. 51, pp. 8*).—Suggestions on picking, packing, and marketing fruit.

The export of our tender fruit, J. W. ROBERTSON (*Canad. Hort., 21 (1898), No. 8, pp. 303–307, figs. 2*).—A reprint from the report of the Commissioner of Agriculture [Canada] on experimental fruit shipments to Great Britain. The picking, packing, and shipping of fruit, and the construction of fruit packages, are briefly discussed. Tables show the amount of various fruits imported by Great Britain from different countries.

Influence of the honey bee on the fruit crop, L. D. STILSON (*Nebraska Farmer, 26 (1898), No. 35, p. 554*).—A popular article read before the Nebraska and Southwestern Iowa Horticultural Societies.

Chemical fertilizers for garden and orchard, R. DUMONT (*Prog. Agr. et Vit., 30 (1898), No. 29, pp. 78–82*).

The use of fertilizers in horticulture, A. HÉBERT and G. TRUFFAUT (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 25, pp. 1831–1834*).

The propagation of plants by cuttings (*Wiener Illus. Gart. Ztg., 23 (1898), No. 8–9, pp. 295–299*).—A popular article on cuttage.

Selection in its relation to horticulture, C. L. ALLEN (*Eastern New York Hort., 2 (1898), No. 1, pp. 11, 12*).

Notes on horticultural nomenclature, F. A. WAUGH (*New York: American Gardening, 1898, pp. 26*).—This consists of six essays under the following heads: General problems, Pomological rules, The names of garden vegetables, Examples of scientific methods, Property rights in names, and Hints on naming. The essays are intended as suggestions for nurserymen, fruit growers, gardeners, seed growers, plant breeders, and students of horticulture. The first five essays were first published in Country Gentleman, vol. 63.

Fruit evaporation, H. E. DOSCH (*California Fruit Grower, 23 (1898), No. 3, p. 4*).

Home canning of fruit, Mrs. W. F. JENKINS (*Nebraska Hort. Soc. Rpt. 1896, pp. 203, 204*).—Directions are given for canning strawberries, cherries, plums, apples, peaches, pears, and sweet corn.

Thinning fruit (*Canad. Hort., 21 (1898), No. 7, pp. 264–266, fig. 1*).—A reprint from U. S. Dept. Agr. Farmers' Bulletin 73.

Forcing vegetables, A. HERRINGTON (*Amer. Gard., 19 (1898), No. 196, pp. 667, 668*).—Notes on the forcing of cauliflowers, beets, onions, carrots, radishes, lettuce, rhubarb, asparagus, and chicory.

Originating new vegetables, A. LOW (*Gardening, 6 (1898), No. 138, pp. 280, 281*).—A paper read before the Massachusetts Horticultural Society.

Sweet corn for New Hampshire, F. W. RANE (*New Hampshire Sta. Bul. 51, pp. 33–46, figs. 3*).—A test of 41 varieties of sweet corn is reported. The data obtained are recorded in notes and tables showing earliness, quality, yield, size, prevalence of smut, etc. Illustrations are given showing stalks, whole ears, and cross sections of ears of the different varieties. The following varieties gave the best results: *Extra early*—Extra Early Beverly, Eastman Early, Early Fordhook, First of All, White Cob; *early*—Crosby Early; *medium*—Asylum Sugar, First Crop, Early Essex, Squantum; *late*—Hance Early, Triumph Sugar, Stowell Evergreen, Country Gentleman.

Lettuce growing in Florida, P. F. WILSON (*Florida Farmer and Fruit Grower, n. ser., 10 (1898), No. 40, p. 630*).

A study of lettuces, W. F. MASSEY (*North Carolina Sta. Bul. 147, pp. 267–271*).—The bulletin gives suggestions on the winter culture of lettuce and reports a variety test of lettuce. Notes are given on 34 varieties tested at the station.

How to grow mushrooms, D. FRASER (*Amer. Gard., 19 (1898), No. 192, Sup., pp. 1, 2*).—A prize essay on mushroom culture.

Tomato growing, E. B. VOORHEES (*U. S. Dept. Agr. Farmers' Bul. 76, pp. 29*).—The bulletin treats of tomato culture for the early market, for the medium and late crops, for canneries, and in the greenhouse; discusses the selection of varieties, growing young plants, selection and preparation of soil, manures and fertilizers, setting and training plants, cultivation, pollination, cost, yield and value of crops, markets and prices, etc. The insect enemies of the tomato are briefly considered. Notes are given on fungus diseases of tomatoes by B. D. Halstead.

Advantages of cultivation (*California Fruit Grower, 23 (1898), No. 12, p. 1, figs. 3*).—The article is from California Station Bulletin 121 and shows the benefits derived from cultivating orchards.

Apple culture near London, J. HUDSON (*Garden, 54 (1898), No. 1395, pp. 120–122*).—Notes on culture and varieties of apples suitable to the locality of London.

Some principles in Delaware apple culture, G. H. POWELL (*Delaware Sta. Bul. 38, pp. 20, figs. 9*).—This is a popular bulletin discussing the statistics of the apple industry in Delaware, and giving practical suggestions on apple growing in the State. The lack of prominence of apple culture is thought to be due to the selection of varieties not adapted to the conditions of the region. The principles on which the selection of varieties should be based are noted. A number of varieties of apples are described.

The principles and practice of pruning, W. C. WORSDELL (*Gard. Chron., 3. ser., 24 (1898), No. 608, pp. 133, 134*).

Gumming of stone fruits, S. A. BEACH (*Amer. Gard., 19 (1898), No. 192, p. 606*).—A brief résumé of what is known regarding the cause of the gumming of stone fruits.

Grafting the plum and cherry, N. E. HANSEN (*Nebraska Hort. Soc. Rpt. 1895, pp. 179–184, fig. 1*).—The propagation of cherries and plums by grafting is described.

Classification of varieties of peaches, R. H. PRICE (*Amer. Gard., 19 (1898), No. 189, p. 560*).—A paper read before the American Pomological Society.

Edible fruits indigenous to Queensland, F. M. BAILEY (*Queensland Agr. Jour., 2 (1898), No. 6, pp. 471, 472, pl. 1*).—Descriptions are given of *Davidsonia pruriens* and *Eugenia eucalyptoides*.

Currant bushes failing to bear fruit, A. P. AITKIN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 293–299*).—The author reports analyses of the soil of an orchard to determine the cause of the failure of currants to fruit. The cause was not ascertained.

Strawberries, C. W. MATTHEWS (*Kentucky Sta. Bul. 73, pp. 27–42*).—The bulletin gives directions for the culture of strawberries and descriptive notes on 65 varieties based on work at the station and on the experience of some 130 strawberry growers of the State. The favorite market varieties for Kentucky in order of merit are Bubach, Haverland, Gandy, Crescent, Michel, and Warfield.

Growing strawberries by irrigation, J. W. STEVENSON (*Nebraska Hort. Soc. Rpt. 1896, pp. 17–21*).—The author's experience in the use of windmills for irrigating strawberries is given.

Judging or scoring fruit, W. R. LAZENBY (*Country Gent., 63 (1898), No. 2379, p. 688*).—Suggested scales of points for judging apples, grapes, strawberries, and tomatoes are given and the scale of points for apples is discussed in detail.

Grape pruning, E. H. RAINFORD (*Queensland Agr. Jour., 2 (1898), No. 6, pp. 462–470, pl. 1, figs. 11*).—A popular article giving directions for pruning grapes.

Stocks for grafting grapes, P. GERVAIS (*Prog. Agr. et Vit., 30 (1898), No. 38, pp. 331–341*).—This is a report presented to the Congrès viticole de Lyon and to the Congrès international d'agriculture de Lausanne. The use of American grapes (*Vitis rupestris*, *V. riparia*, and *V. berlandieri*), their hybrids and varieties, and hybrids between them and *V. vinifera* as stocks resistant to phylloxera are discussed.

Notes on self-fertility of cultivated grapes, S. A. BEACH (*Amer. Gard., 19 (1898), No. 196, pp. 666, 667, fig. 1*).—A paper read before the Society for the Promotion of Agricultural Science. The data included in this article have previously appeared in the New York State Station reports (E. S. R., 9, p. 52).

Objects and methods of crossing the grape, N. E. HANSEN (*Nebraska Hort. Soc. Rpt. 1895, pp. 27–30*).

A new departure in grape hybrids (*Amer. Gard., 19 (1898), No. 196, p. 669, figs. 2*).—The production of three new grapes, La Salle, San Jacinto, and De Soto, all hybrids of Scuppernong, is noted. The varieties are described and San Jacinto and De Soto are figured.

Vineyard management, F. W. CARD (*Nebraska Hort. Soc. Rpt. 1895, pp. 33–50, figs. 7*).

Grape growing and wine making in the Caucasus, VIII (*Tiflis: Government of Tiflis, 1897, pp. 176; abs. in Selsk. Khoz. i Lyesov., 188 (1898), Jan., pp. 239, 240*).

The almond and its varieties (*Garden, 54 (1898), No. 1395, pp. 122, 123, pl. 1*).—Brief notes.

The cultivation of the hazelnut, G. COOTE (*Oregon Sta. Bul. 52, pp. 3–7, pl. 1, figs. 2*).

Growing the pecan, S. POWERS (*Country Gent., 63 (1898), No. 2377, p. 655*).—Notes on pecan culture.

Ornamenting home grounds, W. M. MUNSON (*Maine Sta. Bul. 42, pp. 8*).—The bulletin gives suggestions on making lawns and flower gardens, the planting and

arrangement of trees and shrubs, the choice of plants, etc. A list of native trees and shrubs valuable for planting is added.

The pruning of ornamental plants (*Wiener Illus. Gart. Ztg.*, 23 (1898), No. 8–9, pp. 292–294).—The main principles of pruning ornamental plants are said to be to cut back weak growths to a few buds and stronger growths only a little, and to prune early blooming kinds of plants in summer after blooming and late blooming kinds in fall, winter, or early spring. A list of plants is given and the season in which they should be pruned is indicated.

Showy annuals, F. BRUNTON (*Canad. Hort.*, 21 (1898), No. 7, pp. 274–277).—Notes on the culture of a number of annual flowering plants useful for mixed borders.

The species of Camellia (*Garden*, 54 (1898), No. 1401, pp. 242, 243, pl. 1, figs. 2).—Notes on the ornamental value of camellias and descriptions of several species.

Cannas in 1898, D. ZIRNGIEBEL (*Florists' Exchange*, 10 (1898), No. 40, p. 939).—Lists of cannas regarded as best by the author are given, with brief notes on their value for ornamental purposes.

Growing roses under glass, N. BUTTERBACH (*Amer. Gard.*, 19 (1898), No. 197, Sup., pp. 1, 2).—A prize paper on rose culture under glass.

Growing roses under glass, T. HARRISON (*Amer. Gard.*, 19 (1898), No. 197, Sup., pp. 2, 3).—A prize essay on rose culture under glass.

Violets and how to grow them, F. THAWITE (*Amer. Gard.*, 19 (1898), No. 188, Sup., pp. 10, 11).

Improvement in varieties and improvement in cultural methods as exemplified in high grade flowers, E. G. HILL (*New England Florist*, 4 (1898), No. 25, pp. 291, 292; *Florists' Exchange*, 10 (1898), No. 34, pp. 804, 805; *Amer. Florist*, 14 (1898), No. 533, pp. 90–92).—A paper read before the Society of American Florists and Ornamental Horticulturists.

FORESTRY.

Woods adapted for the manufacture of paper pulp, F. ROTH (*Forester*, 4 (1898), No. 3, pp. 60, 62, 63).—The author states that according to a canvass made in 1888 by the Division of Forestry of this Department, of the 240 wood-pulp mills then reporting nearly half used nothing but spruce timber, about 25 per cent used spruce and poplar, and 6 per cent used poplar alone, the others using a variety of woods, such as pine, hemlock, basswood, balsam, cypress, birch, maple, beech, buckeye, and gum. Considering the rapid increase of the wood-pulp industry and the reduction of the supply, the question naturally arises as to what shall prove a substitute for the spruce. The characteristics of different woods and their relative value for use in the manufacture of pulp are referred to, and the author in concluding states that—

"From the standpoint of a supply, it is quite probable that the conifers will be in the future, as they have been in the past, the main pulp woods of our country. They are still quite abundant and any step toward protection and reforestation, such as may naturally be expected in the near future, will insure new supplies by the time the present stands are cut.

"In the New England States and the East generally spruce will probably continue, aided by hemlock and possibly by second-growth pine. In the Lake Region, hemlock, together with scattered spruce and balsam, will furnish pulp wood for a considerable period and when this is exhausted the pine forests may be expected to take their place. Of the hard woods only the basswood appears sufficiently abundant to warrant its consideration as a source of long time supply.

"In the South coniferous material is found in the spruce, white pine, and hemlock

of the mountains and still more in the vast bodies of hard pines (loblolly, short leaf, long leaf, etc.). When the chemical processes are adapted to the use of these resinous hard pines, the South will be in position to support a great number of pulp mills.

"Western United States, with their extensive forests of conifers, are in good position to supply large quantities of pulp, but the different kinds of spruce, fir, etc., have not been sufficiently studied to warrant any detailed statement."

The sustained yield of spruce lands, G. PINCHOT (*Forester, 4 (1898), No. 3, pp. 56–59*).—This paper, which is an abstract of an address read before the American Paper and Pulp Association, February, 1898, reviews the spruce growth of the Ne-ha-sa-ne Park in the Adirondack forests. The abundant reproduction of spruce and its ability to survive under heavy shade are shown in the data given as to the number of trees in more than 1,000 acres of this park. The author has tabulated the number of trees on this area and it appears there are 314,000, of which 150,228 are 2 in. or more in diameter.

The rate of growth for the past 10 years, as shown by measurements of 300 trees which were of marketable size, ranging from 9 to 27 in. in diameter, shows that the mean annual growth is about 0.11 in.; or, on an average, that about 9 years is required to add 1 in. in diameter to a spruce tree after it has attained merchantable size. This rate of growth is considerably less than was originally supposed.

Financial returns of forest administration in Bavaria (*Forester, 4 (1898), No. 3, pp. 61, 65*).—The forest area of Bavaria is said to be about 34 per cent of the total area of the Kingdom. One third of this area is owned by the State, one-half by private owners, and the rest by villages and corporations. Since 1830 the State has spent about $8,000,000 in acquiring additional forest property. Of the 6,200,000 acres of forest, about 46 per cent is stocked with spruce from which the lumber is usually harvested at an age of 120 years; 30 per cent is pine, mostly Scotch pine, and is largely used as firewood, generally being cut down at an age of 80 years or less; the rest is stocked with hard woods, mostly beech, which is allowed to grow to an age of about 120 years. Some white oak is grown, part of which is managed as tan-bark coppice, being cut every 15 to 25 years, while other trees are allowed to grow into large trees for which about 180 years are necessary in this region. The yield per acre is generally large, the State forest yielding on an average about 61 cu. ft. for every year's growth over the entire area, so there is an annual cut of about 120,000,000 cu. ft. of timber and firewood. The money returns of the Bavarian State forest are somewhat less than those of the forests in Saxony and Wurttemberg. This is said to be partially due to the prevalence of mountain lands which reduce the yield while increasing the cost of operations. Improved methods of administration, however, have increased the net revenue so that the income which in 1850 amounted to about $1 per acre, is now $1.92, the net income of the State amounting to about $4,000,000 per year.

The conifers of China, L. BEISSNER (*Bul. Soc. Bot. Ital., 1898, No. 6, pp. 166–170*).

Tilia cordata, E. G. BAKER (*Jour. Bot.* [*London*], *36* (*1898*), *No. 428, pp. 318, 319*).

An exact method for determining the season in which timber has been felled, P. I. RASHEVSKI (*Warsaw, 1897, pp. 17: abs. in Selsk. Khoz. i Lyesor., 187* (*1897*), *p. 446*).—The author describes a method for determining by use of the microscope whether a given piece of timber was felled in summer or winter. The method is illustrated by drawings of microscopic sections of pine felled in different seasons.—P. FIREMAN.

SEEDS—WEEDS.

Heat of imbibition by seeds, G. MACLOSKIE (*Bul. Torrey Bot. Club, 25* (*1898*), *No. 5, pp. 272–274*).—The author states that the explanation of the production of heat in germinating seeds by destructive metabolism is not sufficient to explain the rising of temperature or certain cases of germination which have occurred at very low temperatures. He reviews briefly the various opinions relative to the physics of imbibition, and describes a limited experiment in which dried peas with water were placed in a bottle and beside it a control bottle containing water, the initial temperature of the two being the same. In about an hour the temperature of the first bottle had increased about 1° C. over the check and remained about this much higher for 3 days, when the peas began to germinate.

In the second experiment, conducted in a somewhat similar manner, the author used dry split peas devoid of seed coat, without radicle or plumule, so there could be no germination. They absorbed water quickly and in a short time the temperature was 1° C. higher than that of the control bottle. This continued for 15 hours, by which time the seeds had become thoroughly saturated, when the temperature fell to that of the water in the other bottle. The author states that a difference of 1° C. will certainly not appear insignificant since the temperature of germinating peas was only 1.5° C. higher than the surrounding air, as determined by experiments of Sachs. No attempt was made to estimate quantitatively the amount of heat which was evolved.

The author believes that in the experiments cited by Uloth in 1871, in which seeds were found germinating in ice, while the initial heat may have been due to some external cause, after the seeds had become wet the heat produced by imbibition might have melted the ice to such an extent as to account for the germination.

The influence of X-rays on germination, MALDINEY and THOUVENIN (*Rev. Gén. Bot., 10, No. 111, pp. 81–86, pls. 2*).—The authors briefly review the somewhat limited literature on this subject and give in some detail a series of interesting experiments in which the effect of X-rays on the germination of a number of seed was investigated. The seeds tested were millet, *Convolvulus arvensis*, and *Lepidium sativum*. The form of apparatus used is figured and described. Check seeds were protected from the action of the X-rays by means of leaden plates. From the results of the experiments the authors conclude that X-rays

hasten germination somewhat, and that they are without any influence on the production of chlorophyll in the seedlings.

Effect of different temperatures of water on the germination of olive seeds, N. PASSERINI (*Bul. Soc. Bot. Ital., 1898, No. 3, pp. 71–73*).—After removing the pericarp from a number of olives the seeds of 8 lots were subjected for 10 minutes to the action of water of different temperatures, the initial temperature of which varied from 30 to 100° C. The seeds were then planted, and the germinations for 7 months are tabulated. It appears that the germination of the olive seeds was accelerated when they were treated with water heated to from 40 to 50°, and the maximum was reached at 70° C. When the water was hotter than 90° C. there was no germination, the seed having been killed.

The woolly mullein, H. GARMAN (*Kentucky Sta. Bul. 70, pp. 99–107, pls. 2, map 1*).—In continuation of his investigations (E. S. R., 9, p. 1024) on this weed (*Verbascum phlomoides*), the author describes its distribution and some of its characteristics. As now known, the woolly mullein has an uneven distribution over about 50 square miles, including portions of 4 counties. The main distribution seems to be along the Nolin River, and it is thought the weed was probably introduced originally somewhere near the headwaters of this stream. The effect on germination of soaking the seed of this plant was investigated by the Division of Botany of this Department, and a report given in the bulletin shows that an average of 73 per cent germinated after floating for 7 days in a bowl of water and 69 per cent after having been in water for 14 days: so that practically the seeds would not lose their vitality by being carried any ordinary distance down stream.

Notes are given on the history of this weed in Kentucky and on its distribution in Europe. It does not thrive in cultivated fields when these are properly cared for, but is chiefly a frequenter of roadsides, meadows, and pastures and much resembles in this respect the other mulleins, to which it is nearly related. A description of the plant together with photogravures are given, and it is stated that it begins to flower early in June when not more than 2 or 3 ft. high, at which time it is often unbranched. It continues to produce flowers and put out lateral branches and, if growing on good soil, attains a height of 8 or 10 ft. It is very prolific in the production of seed and on this account might become a serious pest.

Vegetative propagation of perennial weeds, A. S. HITCHCOCK and G. L. CLOTHIER (*Kansas Sta. Bul. 76, pp. 23, pls. 12*).—This bulletin, which is the fifth report on Kansas weeds, discusses the methods of vegetative propagation of perennial weeds. The weeds are divided according to the methods of their propagation into 3 classes. (1) those reproducing by creeping roots: Sumac (*Rhus glabra*), perennial ragweed (*Ambrosia psilostachya*), pasture thistle, Indian hemp, milkweed (*Asclepias cornuti*), climbing milkweed (*Enslenia albida*), bindweed

(*Convolvulus arvensis*), and sheep sorrel; (2) those from creeping stems: Poison ivy (*Rhus toxicodendron*), wild rose (*Rosa arkansana*), elder, golden-rods (*Solidago serotina* and *S. canadensis*), sunflowers (*Helianthus grosse-serratus* and *H. maximiliani*), wild artichoke (*H. tuberosus*), white morning-glory (*Convolvulus sepium*), smartweed (*Polygonum muhlenbergii*), nettle (*Urtica gracilis*), and nut grass (*Cyperus esculentus*); and (3) those which form crowns: Yellowwood sorrel (*Oxalis corniculata*), redroot (*Ceanothus ovatus*), wild senna (*Cassia marilandica*), ironweed (*Vernonia baldwinii*), golden-rod (*Solidago rigida*), ox-eye daisy, dandelion, white vervain (*Verbena urticæfolia*), blue vervain (*V. stricta*), catnip, motherwort, plantain (*Plantago rugellii*), rib grass, wild four-o'clock (*Oxybaphus nyctagineus*), pokeweed, patience dock, pale dock (*Rumex altissimus*), curled dock, *Paspalum setaceum*, drop-seed grass (*Sporobolus cryptandrus*), and *Eragrostis pectinacea spectabilis*.

In addition, some modification of these methods of propagation is shown in the case of the horse nettle, ground cherry, wild artichoke, nut grass, dandelion, and rib grass. Methods for the destruction of perennial weeds are discussed at some length, based on the necessity of the development by the plant of some green leaves for the production of underground parts. The authors investigated the ability of root cuttings to produce adventitious roots in the case of ground cherries, milkweeds, pasture thistles, bindweeds, climbing milkweeds, dandelion, rib grass, and Jerusalem artichokes.

The underground parts of the various weeds previously mentioned are figured and described in considerable detail.

Notes gleaned by an experience in managing a weed garden, W. J. BEAL (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 35–52*).—The author gives a report of observations made on a weed garden which has been in existence for about 10 years at the Michigan Agricultural College. The soil of the different plats has been given no cultivation and has become very compact. As would be expected whenever plants were at all crowded, those along the margin of the plats were much more vigorous than those in the middle. The perennial and biennial plants have remained in their respective plats, while the annuals have usually seeded themselves and have also found their way to adjacent plats. The growth of quite a number of species is described in considerable detail. Many of the species have decreased in vigor.

A list is given of 127 species of weeds which may be expected in central Michigan, the arrangement being alphabetical under the scientific names. An outline or syllabus is also given for a short course in the study of weeds and a bibliography of over 100 references to weeds and weed eradication.

On the destruction of cuscuta, E. NOFFRAY (*Agr. Rationnelle, 1898, No. 12*).

Œnanthe crocata: A study of its botany and its pathogenic effect on men and certain animals, C. DEMOOR (*Œnanthe crocata. Étude botanique et étude des effets pathogenetiques observés chez l'homme sain et certains animaux. Brussels: H. Lamertin, 1898, No. 83*).

Poisonous plants growing in meadows and pastures, E. NOFFRAY (*Agr. Rationnelle, 1898, No. 15*).

Exchange seed list, W. A. SETCHELL and J. B. DAVY (*California Sta., March, 1898, pp. 8*).—A list is given of duplicate seeds of the botanic garden which are offered for exchange only for seeds from other experiment stations and botanic gardens in the United States and abroad. In all, 220 species and varieties are listed.

Seed travelers, C. M. WEED (*Boston: Ginn & Co., 1898, pp. 58, ill.*).—Treats of the methods of dispersal of various common seeds.

DISEASES OF PLANTS.

Diseases of plants, H. L. BOLLEY (*North Dakota Sta. Rpt. 1897, pp. 43–50*).—Aside from work on potato scab and rusts of cereal grains, the author has been collecting information relative to other diseases of plants. Some of the observations have not yet been published.

A brief report is given of a disease designated as blighting of wheat. Usually the heads have the appearance of sun scald or injuries resulting from excessive drought. During the past season the disease was especially destructive. At harvest a large portion of the heads were found with the upper half unfilled. Microscopic study of these blighted heads showed that the glumes and blighted grains were thoroughly infested with a fungus growth. Specimens have been examined by the author and others, and as yet there is no agreement as to the exact nature of the fungus. The author, however, is induced to believe that the fungus is a species of Alternaria. Further investigations are promised.

The author continued his investigation of the smuts of cereals, experimenting with formalin, "Ceres Pulver," and a tobacco extract known in the trade as "Roseleaf." The effect of these fungicides on the prevention of smuts of wheat, oats, and millet is shown in tables, and a comparison made with hot water and corrosive sublimate treatments. The treatment of wheat with "Roseleaf" seemed to increase the smut rather than diminish it. Formalin and corrosive sublimate gave the best results. In the treatment of oats the "Ceres Pulver" and formalin seemed to be equally efficient in preventing smut. The formalin solution was very efficient in preventing smut of millet. An experiment for the prevention of barley smut was attempted, but on account of the very small percentage of disease on the untreated plat, no conclusions can be drawn from the trial.

The comparative resistance of different varieties of oats to rust was also investigated, and further results are to be forthcoming.

The effect of different dates of seeding or possible variation in soil conditions upon the development of smuts in grain was investigated with wheat, oats, barley, and millet. This work was in continuation of that begun in 1896, and for the present the author thinks it is desirable to withhold the publication of results.

Prevalent diseases of cucumbers, melons, and tomatoes, A. D. SELBY (*Ohio Sta. Bul. 89, pp. 99–122, pls. 3, map 1*).—The author calls

attention to the serious decrease in yield of cucumbers for the season of 1897. The principal cause of this diminished yield is attributed to attacks of the downy mildew (*Plasmopara cubensis*) and the anthracnose (*Colletotrichum lagenarium*). Of these the downy mildew was the more destructive. The history and distribution of both these diseases is given. They are reported as having been observed in 10 States.

An experiment was conducted under the author's direction for the prevention of the downy mildew by 2 applications of Bordeaux mixture. Comparing the yields of sprayed and unsprayed rows, it was found that 25 sprayed rows yielded 51 bu. of cucumbers, while an equal number of unsprayed rows gave 38.4 bu. The cost of spraying seems unnecessarily high and could probably have been considerably reduced. Suggestions are given for the planting of cucumbers, allowing for roadways, so that power sprayers may be used.

The leaf blight of melons, due to *Altenaria* sp., which was described and figured in Bulletin 73 of the station (E. S. R., 8, p. 991), has again proved quite destructive during the season of 1897, and has extended its attacks to watermelon leaves. The muskmelon leaves, however, showed the earliest symptoms, dying off rapidly, with the characteristic spotting.

Notes are given on the tomato leaf blight fungus (*Septoria lycopersici*), which seems to have become well established throughout most of the State. It may be successfully prevented by the thorough use of Bordeaux mixture.

An experiment was conducted in which seeds were treated with copper sulphate solution and with hot water, to ascertain the effect of such treatment on the prevention of the tomato anthracnose. Soaking the seeds 1 and 2 hours in 10 per cent solution of copper sulphate or immersion for 5 minutes in water heated to 133° did no injury to the germination. The absence of all traces of diseases in these trials prevented any conclusions relative to the treatment of the disease.

Plant diseases in Java, M. RACIBORSKI (*Ztschr. Pflanzenkrank., 8 (1898), No. 2, pp. 66, 67*).—The author reports the existence in Java of 2 undescribed diseases of the cowpea and the peanut. The fungi attack the leaves of their respective hosts and have both proved very destructive.

The disease of the cowpea is caused by *Cercospora vignæ*. On the upper surface of the leaves it produces rounded or somewhat irregular spots 0.5 to 2 cm. in diameter. These spots often coalesce and the tissue becomes dead. On the under side of the leaves the spots are brownish gray, and after the formation of the spores they become dark rusty gray. The spots are not bordered. The mycelium is found about the fibro-vascular bundles and in the spongy parenchyma, but it does not send haustoria into the cells. The conidiophores are borne upon the under side of the leaves. The conidia are 3.5 to 5 μ in diameter and are very slender. The small ones measure 20 μ in

length and are 1-celled, while the most are 30 to 50 μ and 2 or 3 celled, while occasionally specimens are found 100 μ in length and have 8 to 10 cells. The conidia are able to produce spots on sound leaves in from 4 to 5 days; when severely attacked the leaves quickly dry up and fall from the plant.

The disease of the peanut is said to be due to an undescribed fungus (*Septoglœum arachidis*) and whole fields are said to have been destroyed by it. It produces round, sharply bordered black spots with lighter centers and a clear yellow limiting border. The spots are usually 4 to 5 mm. in diameter, but vary from 3 to 10 mm. While usually found on the lamina and midrib of the leaf, the petioles and stems are also attacked. Infected leaves quickly fall, leaving the bare stems and a few young leaves. The mycelium of this fungus occurs in the parenchyma and sends numerous haustoria into the cells. The conidiophores are small and they bear numerous elliptical conidia, usually single-celled, but sometimes appearing as though 3 to 5 celled. They are 20 to 34 μ in length and 9 μ in diameter. By placing fresh conidia on leaves the characteristic spots are said to have been produced within four days.

A dangerous disease of the white pine (*Gard. Chron., 3. ser., 23 (1898), No. 588, p. 202*).—The author calls attention to the serious disease of *Pinus strobus* due to *Peridermium strobi*. The disease is widely distributed in Germany, Denmark, and elsewhere, and is quite common in the nursery. The symptoms of the disease consist of a swelling on twigs or branches, frequently under a branch whorl. Soon the distinctive blister-like outgrowths appear, bearing the yellowish spores. In a short time the twigs dry up, the needles fall, and no new growth follows.

The alternate generation of this fungus occurs on the black currant, gooseberry, and other species of Ribes. This form is known as *Cronartium ribicolum*, and it appears on the leaves in June as a yellow, rusty coating, followed by a number of brown hair-like outgrowths. On the currants, etc., while destructive, it has not been reported as epidemic. *Pinus strobus* in America is said not to be attacked by this fungus.

Experiments for the control of potato scab, H. GARMAN (*Kentucky Sta. Bul. 72, pp. 9–23*).—In 1896 the author conducted a series of experiments with corrosive sublimate and flowers of sulphur for the prevention of potato scab. The first series was conducted in the greenhouse. A scabby potato was planted in each of 6 10-in. flower pots, the soil in all having been previously baked for several hours. The results obtained by this somewhat limited experiment indicated that sulphur did not exercise any decided effect in checking the scab, while corrosive sublimate proved very efficient.

Later in the same season 10 tenth-acre plats which had been previously used in potato-scab experiments (the ground being infested with a potato-scab fungus) were planted with Early Rose potatoes, the object

of the experiment being to test the relative values of corrosive sublimate and flowers of sulphur. Half of each plat was retained as a check, and the seed planted on the other portions of the first 5 plats was treated for 1 hour with a solution of 4½ oz. of corrosive sublimate to 30 gal. of water. Three of the plats receiving sulphur were given 7½ lbs. and the other 2 received 9 lbs. of sulphur, the sulphur being dusted in the furrows before the seed was dropped. The conclusion drawn from the experiment, the results of which are tabulated, show that corrosive sublimate was quite efficient in checking potato scab, while the sulphur treatment did not possess any special value.

In 1897 the use of corrosive sublimate was further investigated by pot experiments with favorable results. In conclusion the author states that soaking potatoes for an hour in a solution of 4½ oz. of corrosive sublimate in 30 gal. of water is an effective treatment. If stronger solutions are used the period of soaking must be diminished.

The fungicidal action of acetate of copper compared with that of the Bordeaux mixture, A. and F. RAVIZZA (*Bol. Not. Agr., 20 (1898), No. 5, pp. 206–211*).—The authors conducted a series of experiments in which the fungicidal effect of acetate of copper and Bordeaux mixture as preventives of grape Peronospora were compared. The form of acetate of copper used was that known as Stecher's mixture, consisting of 51.3 per cent acetate of copper and 44.3 per cent sulphate of lime. Experiments were made in 3 different localities with these substances, the weather during the summer being hot and rainy and especially favorable for the development of the grape mildew. In the vineyard where the first series of experiments was conducted the soil was cultivated between the rows, wheat and vetches being alternately grown, and liberal applications of cow manure and mineral phosphates were given. The Stecher mixture was guaranteed to contain 350 gm. of basic acetate of copper per kilo of powder. Vines were sprayed May 16, June 13–15, 23–24. In the first application 300 vines were sprayed with a package of the Stecher powder dissolved in 50 liters of water; in the second and third treatments increased strengths of solution were used. In addition to spraying with Bordeaux mixture the vines after being sprayed were powdered with a 3 per cent sulphate of copper powder. The foliage of those vines which received the acetate of copper was noted before the end of the season to be of a darker green color than the leaves of the other vines. The Peronospora appeared during the first days of July upon the vines which received Bordeaux mixture and upon those receiving the Stecher powder about August 1. At that period, the weather being very rainy, the invasion of the fungus was very rapid, especially on those vines which had been treated with the acetate of copper powder. From these experiments the conclusion is drawn that while the acetate of copper was somewhat more efficient than Bordeaux mixture, as it washes off the leaves much more readily, more numerous applications will be required. It is also rec-

ommended that each treatment be followed with the application of powdered sulphate of copper.

A second series of experiments was conducted in a vineyard which was situated on a hillside with a southern exposure, the soil of which was clay. In this experiment different strengths of the 2 fungicides were compared. Three of the sprayings were followed with applications of sulphur. Bordeaux mixture used in full strength and acetate of copper in full strength or in half strength saved the vines from the attacks of the fungus. The half-strength Bordeaux mixture was less efficient, some of the vines being slightly injured. Sugar determinations of the grapes grown on vines receiving the different treatments showed practically no differences.

Another experiment made near by and conducted on a somewhat similar plan proved an almost total failure. In this case the vineyard was in a low-lying place; the soil was wet. Peronospora developed rapidly on the plants and the treatment was evidently begun too late in the season.

The authors conclude from their experiments that the acetate of copper is an active preventive agent against Peronospora, being about equal to Bordeaux mixture and in some respects better, as somewhat less is required than of Bordeaux mixture. The authors think, however, that more than 3 applications are necessary, that number being recommended by the manufacturers of the Stecher powder. From an economic consideration of the subject, they believe acetate of copper is not adapted to general use, as the cost is considerably greater than an equal amount of Bordeaux mixture.

Investigations on the life history of the rust fungi, E. FISCHER (*Beitr. Kryptogamenflora, Schweiz., 1 (1898), No. 1, pp. X+121, pls. 2, figs. 16*).

Notes on the Uredineæ of Mexico, P. DIETEL (*Hedwigia, 37 (1898), No. 4, pp. 202–211*).

Trametes pusilla on sugar cane, M. RACIBORSKI (*Arch. Java Suikerind., 1898, No. 11, pp. 9, 10*).

Concerning the injuries and diseases of fruit trees during 1897 and the relation of the weather to the same, ADERHOLD (*Ueber die in den letzten Jahren in Schleisen besonders hervorgetretenen Schäden und unserer Obstbäume und ihre Beziehungen zum Wetter. Breslau, 1898, pp. 27*).

A disease of mulberry trees in Japan, ICHIKAWA (*Forstl. Naturw. Ztschr., 7 (1898), No. 7, pp. 247, 248*).

A fungus disease of Arundo donax, R. BLANCHARD (*Arch. Parasit., 1 (1898), No. 3, pp. 503–512*).

Pear blight and its treatment, M. B. WAITE (*Eastern New York Hort., 2 (1898), No. 1, pp. 4, 5, figs. 4*).

Notes on Septoria parasitica, RUDOLPH (*Forstl. Naturw. Ztschr., 7 (1898), No. 8, pp. 265–273, pl. 1*).

Mildew and the contest against it in the vineyard, A. I. POGIBKA (*Odessa, 1897, pp. 16; abs. in Selsk. Khoz. i Lyesov., 190 (1898), July, pp. 229, 230*).

Parasitic fungi of the Russian forest trees, A. A. YACHINSKI (*Rpt. Min. Agr. and Govt. Estates, Dept. Forestry. St. Petersburg, 1897, pp. II+150, col. pls. 5; abs. in Selsk. Khoz. i Lyesov., 190 (1898), July, p. 229*).—For foresters and forest growers.

The enemies of agriculture, C. RAMPON (*Les ennemis de l'agriculture Nancy: Berger-Levrault & Co., 1898, pp. VIII + 408, figs. 140*).—Treats of insect injuries, fungus attacks, weeds, etc.

Nematodes in coffee-plant roots, A. ZIMMERMANN (*Meded. S'Lands Plantentuin, 27 (1898), pp. 64, pls. 2, figs. 17*).

The use of copper fungicides in forest protection, C. VON TUBEUF (*Forstl. Naturw. Ztschr., 7 (1898), No. 7, pp. 253–257*).

Handbook for the preparation and use of chemical agents for the prevention of plant diseases, M. HOLLRUNG (*Handbuch der Chemischen Mittel gegen Pflanzenkrankheiten. Herstellung und Anwendung im Grossen. Berlin: Paul Parey, 1898, pp. IV + 178*).—This handbook, although from its title it would appear to be one dealing only with the preparation and use of fungicides, includes insecticides as well. The work is divided into 3 parts, the titles being animal, vegetable, and mineral substances, the latter being arranged according to inorganic and organic substances. The literature of Europe and America has been well reviewed, and the information is fully up to date. More than 125 substances which are considered as having fungicidal or insecticidal value are discussed and numerous formulas given for their preparation. In many cases the specific value of the chemical agents for the prevention of certain insects or diseases is stated. The author has made a valuable contribution to the literature of the subject.

ENTOMOLOGY.

The weight of bees and the loads they carry, C. P. GILLETTE (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 60–63*).—A large number of weighings were made, which resulted in showing that outgoing pure Italian workers average 1.285 gm. or 5,578 bees to the pound; incoming honey-laden workers, 1.982 gm. or 3,532 to the pound; incoming pollen-laden workers, 1.349 gm. or 5,594 to the pound; incoming pollen bearers, 1.285 gm. or 5,447 to the pound, and drones, 3.173 gm. or 2,206 to the pound.

The weights were taken of honey stomachs from incoming workers, of honey loads and pollen loads, with the following average results: Honey stomachs, 0.879 gm. or 7,964 to the pound; honey loads, 0.638 gm. or 10,965 to the pound; and pollen loads, 0.173 gm. or 40,580 to the pound. The object of weighing was to determine the truth of the statement often made by bee keepers that pollen bearers also bear honey. In no case was it found that such was the case. What little honey is found in the stomach or used in sticking pollen to the legs seems to be a store carried with the bee from the hive.

Pterophoridæ of North America, C. H. FERNALD (*Massachusetts Agr. Col. Rpt. 1897, pp. 85–162, pls. 9*).—The subject is treated monographically. After briefly noting the wide geographical distribution, that none of this family have thus far been recognized among fossils, and the few natural enemies (*Pimpla pterophori*, *Limneria pterophoræ*, and *Ichneumon humilis*), the author proceeds with a historical résumé of the literature, and an account of the structure and habits, systematic position, and characteristics of the family, finally treating the various species in detail. Synoptic tables are given with each genus.

The Pterophoridæ fly usually on warm, quiet evenings, when they are occasionally attracted to light, though rarely to sugar. In the daytime they are easily flushed from shrubbery and fly but a short distance. When at rest the wings are held horizontally at right angles to the body with the feathers of the hind wings folded over each other and drawn under the wings. Whether any of the North American species have more than one generation is not known, although in Europe Acanthodactyla and Monodactyla are said to have two generations, and it is very probable that the same may be true in some cases at least in this country. Of the species noted, the food plants of the following are known: those of the others have not yet been discovered: *Trichoptilus lobidactylus* on *Solidago canadensis; Platyptilia cosmodactyla* on Stachys, Aquilegia, Geranium, and Orthocarpus; *P. acanthodactyla* on Stachys, Mentha, Ononis, Calamintha, Pelargonium, and Euphrasia; *P. carduidactyla* on *Cirsium lanceolatum; P. orthocarpi* on Orthocarpus; *P. tesseradactyla* on *Gnaphalium dioicum* and *G. arenarium; Alucita montana* on Solidago; *Pterophorus homodactylus* on Solidago and *Eupatorium purpureum; P. helianthi* on Helianthus; *P. paleaceus* on *Vernonia noveboracensis; P. kellicottii* on Solidago; *P. monodactylus* on *Convolvulus sepium, C. arvensis, Chenopodium album*, and *Atriplex patula; P. eupatorii* on *Eupatorium purpureum; P. grisescens* on Artemisia; *P. inquinatus* on *Ambrosia artemisiæfolia*, and *Stenoptilia pterodactyla* on *Veronica chamædrys.*

Some strawberry insects, A. L. QUAINTANCE (*Florida Sta. Bul. 42, pp. 551–600, figs. 23*).—This bulletin treats popularly of the more injurious insects of the strawberry occurring in Florida. Life histories are given more or less in detail and remedies noted. Thrips have been unusually abundant, damaging the strawberry crop throughout the State. Although it affects other field plants during the entire spring and summer, the strawberry plant seems to furnish its favorite food. It attacks different flowers differently. In orange blossoms the petals and stamens are chosen; in strawberries the pistils, resulting in the latter case in preventing or retarding the fertilization of the ovules. On some blossoms the author notes the presence of as many as 65 insects.

Bodies were pressed from females which were regarded as eggs. They measured 0.6 μ by 0.1 μ and were found in numbers of from 2 to 5, usually 3, per insect.

Several remedial mixtures were tried, including a sulphur spray, flowers of sulphur, pyrethrum, pyrethrum and water, pyrethrum decoction, tobacco dust, tobacco decoction, kerosene emulsion, whale-oil soap, etc., but none were found to be as efficient as the compound known as "rose-leaf" insecticide. This was efficient both in killing the insects and in not affecting the taste of the berries, which some of the other insecticides invariably did when employed late. Aside from not affecting the berries, this insecticide is thought superior, from the fact that

a slight stickiness that it possesses prevents the insects from escaping and in the fact that its action is rapid.

The strawberry pamera (*Pamera vincta*) seems to be reported for the first time as of economic importance. In Florida it has been recognized for several years past as an enemy to strawberries. It was observed in 1892 by P. H. Rolfs feeding on the young berries; the "buttoning" of young fruit is attributed to it. In the laboratory insects were observed to feed mainly on the ovaries of the plants.

"Walking around over the berry, the beak was thrust first down into one ovary and then another, frequently 15 or 18 ovaries being pierced during the course of half an hour. As is well known, the ovary is, physiologically, an essential part of the fruit of the strawberry, and if a considerable number of ovaries are destroyed the development of the receptacle—the juicy part of the ripe strawberry—is checked. This insect seems to destroy the vitality of the ovaries which it attacks. In case the attack has been severe, i. e., many of the ovaries of the fruit having been pierced, the berry rarely develops to anything of value. Further growth is greatly checked and the receptacle eventually becomes more or less woody, producing a button. Very young fruit seems to suffer more severely yet. In such fruit the receptacle is also attacked, and it usually results in the blackening and eventual drying up of the berry. This effect was observed repeatedly in the laboratory. Blossoms are sometimes attacked with the same results. One insect may so pierce a very young fruit or blossom that it will die. After a berry has become a third grown it is probably safe from destruction by this insect."

The egg, the 5-nymph, and the adult stage are described, quoting from Say. Some discrepancies were observed by the author between specimens and Say's description.

"The length will average about $\frac{1}{5}$ in., nearly twice that given by Say. However, there is much variation in length; the bodies of some males measure but $\frac{5}{32}$ of an inch, while some of the longest females measure $\frac{5}{16}$ of an inch. The membrane of hemelytra is much clouded with dusky above; below it is milk white. The feet are dusky. The claw and distal segment of each tarsus are blackish, the clouding extending upon the tibia; not whitish. The basal joint of the antennæ is uniformly yellowish, there being no trace of black on distal portion.

"The antennæ of an adult are very similar to that of the nymph, the first joint being short, about two and one-half times as long as thick; second, third, and fourth joints are of about same length; second and third are cylindrical in shape; fourth joint is spindle shaped. First, second, and third joints are uniformly yellow; fourth joint rufous. Tarsi composed of 3 segments."

Laboratory observations resulted in showing that the duration of the life cycle of the insect is as follows: Egg stage, 8 days; first nymph stage, 5 days; second, 3 days; third, 3 days; fourth, 3 days; fifth, 5 days; total to adult stage, 27 days. Adults were kept in the breeding cage 20 days, or until they escaped.

In the field it was observed that young are less affected than old fields and that the custom of mulching offers the insects admirable places for breeding. The insect is thought to be indigenous to the State and its taste for strawberries acquired. Spraying with rose-leaf insecticide is recommended.

The tarnished plant bug (*Lygus lineolaris*) is regarded as injurious,

although it can not be regarded at present as seriously menacing strawberry growing in Florida. As remedies kerosene emulsions and pyrethrum are noted.

The leaf-footed plant bug (*Leptoglossus phyllopus*) not infrequently attacks the strawberry, sucking the fruit and tender shoots, sometimes doing considerable damage, though its usual food plant in Florida appears to be the thistle *Carduus spinosissimus*. Nymphs were observed on the Irish potato. Hand picking is recommended.

The negro bug (*Corimelæna pulicaria*), although more abundant in Florida on blackberries, also frequently does considerable damage to strawberries, the injury being mostly due to the odor it imparts to the berries. Hot water (155° F.) is noted as a remedy.

Cutworms, principally *Agrotis ypsilon*, are frequently abundant. One grower gave the information that he had dug out 600 daily for a week; another that he found 40 near a single plant.

The remaining insects noted are white grubs (*Lachnosterna* spp.), strawberry flea-beetle (*Haltica ignita*), grasshoppers, crickets, the strawberry weevil, the strawberry crown borer (*Tyloderma fragariæ*), and strawberry-leaf roller (*Phoxopteris comptana*). The last 2 insects, however, have not yet been found in Florida. The life history of *H. ignita* is thought to be somewhat similar to that of the grapevine flea-beetle. No record is known of the larvæ feeding on the leaves of the plant, and it is regarded as possible that they attack the roots.

Two spraying machines are figured.

Some injurious insects of the orchard, E. E. FAVILLE and P. J. PARROTT (*Kansas Sta. Bul. 77, pp. 25–62, figs. 32*).—This is a popular discussion of the following insects, including descriptions, life histories, habits, injuries, remedies, etc.: Cankerworm (*Paleacrita vernata*), codling moth (*Carpocapsa pomonella*), tent caterpillar (*Clisiocampa americana*), plum curculio (*Conotrachelus nenuphar*), plum gouger (*Coccotorus scutellaris*), peach-tree borer (*Sannina exitiosa*), flat-headed borer (*Chrysobothris femorata*), round-headed borer (*Saperda candida*), San José scale (*Aspidiotus perniciosus*), and elm-twig girdler (*Oncideres cingulatus*).

The spring cankerworm has steadily spread into the fruit regions of the State until now it is regarded as one of the leading orchard pests. The insect attacks forest and shade trees as well as fruit trees. The remedies suggested are to prevent the wingless female from ascending the trunks of trees, and to spray the trees with poisons. The first may be done by the use of sticky mixtures, such as printers' ink, pine tar, resin and castor oil, dendrolene, raupenleim, etc., applied as a band to the trunk of the trees or by the use of collars of tin, paper, etc., fastened about the trees. The author gives the following summary of results of spraying: "Trees sprayed with Paris green were not scalded; loss from the work of larvæ from 1 per cent to 5 per cent. Trees sprayed with soluble arsenic solution showed leaves scalded 5 per cent, larvæ completely destroyed. Trees sprayed with insoluble arsenic solution showed leaves free of scald, 1 per cent of leaves destroyed by larvæ."

The plum curculio is the worst enemy of the plum, having become distributed throughout the State. The remedies commonly used—spraying and jarring—are recommended.

The peach-tree borer is regarded as the most widely distributed insect enemy of the peach in the State. The author believes that the danger to the tree from digging out the larvæ makes that remedy impracticable. The best method is thought to be any means of preventing the adult insect from depositing its eggs. Hilling up the soil around the trees, or placing tarred paper or even wire netting about the trunks to the height of 2 ft., is suggested. Obnoxious washes which will keep the moths away are noted.

As remedies against the flat-headed borer, it is suggested to keep the trees in a healthy condition, to stimulate vigorous growth, which will increase the flow of sap and usually cause the death of the larvæ by drowning, to dig out larvæ with a knife, and to use alkaline washes on the trunks of trees.

A spray calendar, giving directions for the treatment of the most important insect enemies and diseases of a number of plants, the preparation of insecticides, fungicides, etc., is included with the bulletin.

The gypsy moth in America, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 11, n. ser., pp. 39, figs. 5, maps 3*).—This bulletin gives the results of an investigation of the gypsy moth made in accordance with a clause in the section of the agricultural appropriation bill making appropriations for the year 1897. A general review of the history of the moth and its introduction into this country, its occurrence in Europe, and the methods of extermination adopted in Massachusetts are given. The only seemingly sound objection to the work, i. e., that large numbers of insectivorous birds and their nests must be destroyed, is answered by the statement that the work of the men is timed where possible so as not to interfere with the nesting of useful birds, and that the nests of the English sparrow are always destroyed where met with.

The value of the burlap method of collecting is brought out, and the fact noted that in 1897 the larvæ seemed to have changed their habits somewhat. Instead of hiding under the burlap in large numbers during the day, as formerly, they were found in the trees. This change seemed to coincide with the general cloudy and damp character of the weather, and was overcome by the greater use of the spraying method and also by jarring the worms from the trees and killing them beneath the burlaps.

The inefficiency of any single method and the ability of the worms to resist poisons is brought out.

The San José scale in 1896 and 1897, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 12, n. ser., pp. 31, fig. 1*).—This bulletin is supplementary to Bulletin 3, n. ser., of the Division (E. S. R., 8, p. 500), and brings together information gained by the economic entomolo-

gists of the country during the past 2 years. A map is given showing the known distribution of the San José scale, accompanied by notes on its present condition in the following States: Alabama, Arkansas, Arizona, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Washington, West Virginia, and Canada.

Seventeen new food plants have been listed. They are as follows:

"*Orchard fruits.*—Pear, peach, apple, plum, cherry, Rocky Mountain dwarf cherry, persimmon, quince, flowering quince. *Small fruits.*—Strawberry. *Bush fruits.*—Raspberry, gooseberry, grape, currant, flowering currant, black currant. *Nut plants.*—Almond, chestnut, pecan, black walnut, English walnut, Japan walnut. *Ornamental plants, forest, and shade trees.*—Rose, hawthorn, spirea, cotoneaster, euonymus, English huckleberry, linden, acacia, elm, osage orange, alder, sumac, weeping willow, English willow, golden willow, laurel-leaved willow, milkweed, catalpa speciosa, Lombardy poplar, Carolina poplar, golden-leaved poplar, silver maple, cut-leaved birch, mountain ash, Japanese quince, actinidia, Citrus trifoliata, red dogwood, snowball, Juneberry, loquat, laurel, and akebia."

The difference between the San José scale and 2 closely allied species, the Putnam scale (*Aspidiotus ancylus*) and the Forbes scale (*A. forbesi*) are pointed out. The relation of climate to the spread of the insect is briefly discussed.

In regard to natural enemies of the scale, the author says that in no case since the publication of the former bulletin have any insect enemies been reported as doing any good. Specimens of Australian ladybirds were distributed in New Jersey and at Washington, but no results have been obtained from them. The identification and study of a parasitic fungus (*Sphærostilbe coccophila*) by the Florida Station (E. S. R., 9, p. 1068) and work with it in New Jersey and elsewhere is noted.

In regard to remedies the work of the Virginia Station with the gas treatment and with pure kerosene (E. S. R., 9, pp. 672, 1067) is reviewed, as is also the work with kerosene at the Georgia, Ohio, and New Jersey Stations (E. S. R., 9, p. 1066; 10, p. 161).

In experiments of the Division of Entomology, peach, pear, cherry, and apple trees sprayed with pure kerosene while their buds were dormant were uninjured. On some of the trees 99 per cent of the scales were killed by the kerosene. Cases are noted, however, in which orchards sprayed with kerosene were very seriously injured. Therefore the author recommends the use of kerosene on a small scale at first to determine whether it can be advantageously used in different localities.

Recent legislation in regard to the San José scale is briefly noted, and the German edict in relation to the importation of plants and fruits from America is given.

A bibliography is given including publications during 1896 and 1897 and omissions from the previous bibliography.

The chinch bug, H. GARMAN (*Kentucky Sta. Bul. 74, pp. 45–70, fig. 1, pls. 7*).—The bulletin discusses the distribution and injury of the chinch bug in Kentucky, its characteristics, habits, etc., and methods of treatment. The meadow lark and quail are noted as the two birds known to feed on the chinch bug. Toads are also said to be useful in destroying this insect. Chinch bug fungi are discussed at considerable length, and methods of growing and using fungi are given. Among other remedies the following are discussed: Barriers, deep plowing, early planting, fertilizers, planting timothy with wheat, and the use of fire, coal oil, steam, etc.

A bibliography of the more important articles on the chinch bug is given, with notes on the scope of each article.

The periodical cicada (Cicada septendecim), or so-called seventeen-year locust, in Ohio, F. M. WEBSTER (*Ohio Sta. Bul. 87, pp. 37–68, figs. 11, pl. 1*).—The structure, life history, habits, injuries, and natural enemies of the cicada are given. The summary of the bulletin is, in part, as follows:

"The principal injury done by the insect is by puncturing the twigs and limbs of trees and shrubs and the canes of raspberry and blackberry bushes.

"There are four well-marked and strong broods in Ohio during the 17-year period.

"The adults are destroyed by the English sparrow and to a small extent by other birds.

"Kerosene emulsion and pyrethrum mixed will destroy the newly emerged adults.

"Hogs root out and destroy the pupæ, and domestic fowls destroy the adults.

"It is best not to prune trees, especially young orchards, the season preceding an occurrence of the Cicada, and it is also better to forego planting during the same period."

List of original types of species in the superfamily Jassoidea, C. P. GILLETTE (*Colorado Sta. Bul. 43, pp. 30, 31*).—This is a list of the species of Jassoidea now in the collections of the College of Agriculture and Experiment Station. "The list is for the information of students in entomology and also for the purpose of correcting a statement in regard to 'true type specimens' made by C. F. Baker in an article entitled 'Notes on the Genus Deltocephalus' and published in the current volume of Psyche, p. 114."

A few new species of Deltocephalus and Athysanus from Colorado, C. P. GILLETTE (*Colorado Sta. Bul. 43, pp. 23–29, figs. 4*).—The following new species are described: *Deltocephalus parvulus, D. cookei, D. blandus, D. labiata, D. atropuncta,* and *Athysanus ornatus.*

Descriptions of new genera and species of the Geometrina of North America, G. D. HULST (*Canad. Ent., 30 (1898), No. 7, pp. 191–195*).—*Diastictis benigna, D. sericeata, Jubarella,* n. g., *J. danbyi, Spodoptera kunzei, Æthyctera lineata. Alcis mæstosa, A. lallata, Selidosema configurata, S. lachrymosa, Cleora subaustralis,* and *C. pedicellata.*

Two new species of Kermes from Kansas, E. E. BOGUE (*Canad. Ent., 30 (1898), No. 7, p. 172*).—*Kermes pubescens,* on twigs and leaves of oak (*Quercus macrocarpa* and *Q. prinoides*); reported also on *Q. macrocarpa.* It occurs very thickly on young twigs and leaves. *Kermes concinnulus* on *Q. macrocarpa,* allied to *K. cockerelli.*

Concerning the ovular envelopes of some of the Chrysomelidæ, A. LECAILLON (*Arch. Anat. Micros., 2 (1898), No. 1, pp. 89–117, pl. 1*).

The development of the embryo of some Chrysomelidæ, A. LECAILLON (*Arch. Anat. Micros., 2 (1898), No. 1, pp. 118–176, pl. 1*).

Structure and classification of insects (*Bul. Soc. Cent. Hort. Seine-Inférieure, 2. ser., 2 (1898), No. 2, pp. 153–178*).

The San José scale, W. J. PANTON (*Ontario Agr. Col. and Expt. Farm Bul. 106, pp. 3–7, fig. 1*).—A popular article on the San José scale, its life history, injuries, distribution, etc. The various remedies in use are briefly considered.

The San José scale in Oklahoma, E. E. BOGUE (*Oklahoma Sta. Bul. 31, pp. 8, figs. 3*).—The San José scale is reported as having invaded the Territory, and this bulletin is a brief popular account of it and its life history. The source of introduction seems at present to be from Texas.

As remedies salt, sulphur, and lime solution were employed with success. It is thought that in Oklahoma it would be best for every man to be a law to himself rather than depend upon restrictive legislation.

The importation of the San José scale (Aspidiotus perniciosus) from Japan, F. M. WEBSTER (*Canad. Ent., 30 (1898), No. 7, pp. 169–172*).—It is noted that in April, 1898, the author found *Aspidiotus perniciosus* and *Diplosus amygdali* on Japanese white flowering cherry trees which were received directly from Japan during the winter of 1896–97. The isolation of the trees, although they had been growing in this country for a year, is thought sufficient proof that the scales came from Japan. Another lot of trees which had never been removed from the storehouse in which they were placed when they came from Japan were examined and found infested with the pernicious scale. The author believes with T. D. A. Cockerell that the scale is a native of Japan, and explains the fact that it is not as injurious and numerous there by the probable existence and influence of natural enemies, which he suggests might be brought to this country.

The San José scale in Massachusetts, A. H. KIRKLAND (*Massachusetts Crop Rpt., June, 1898, pp. 24–38, figs. 3*).—A popular summary of recent literature on and a discussion of this insect as found in Massachusetts. To a discussion of the usual questions, one on the nursery question is added. The natural laws of trade are thought more potent than those framed by legislatures. There is added beside very good advice to nurserymen and purchasers.

San José scale (*Pennsylvania Dept. Agr. Bul. 34, pp. 45–49*).—Notes are given on Rolfs' and Smith's work with the San José scale.

Erratum.—The statement on page 271 of the preceding number of the Record, to the effect that the appearance of the San José scale in Iowa was noted, is erroneous. The authors state instead that "no occurrences have as yet been detected."

The allied species in Europe of the San José scale, FRANK and KRÜGER (*Gartenflora, 47 (1898), No. 15, pp. 393–400, figs. 6*).

A contribution to the knowledge of the red spider (Tetranchyus telarius), C. VON TUBEUF (*Forstl. Naturw. Ztschr., 7 (1898), No. 7, pp. 248–251, figs. 3*).

Insects injurious to roses, E. LUCET (*Bul. Soc. Cent. Hort. Seine-Inférieure, 2. ser., 2 (1898), No. 2, pp. 135–152, pl. 1*).—This is one of a series of articles giving descriptions of insects injurious to roses, with remedies, etc.

Insect enemies of the grapevine, L. BRUNER (*Nebraska Hort. Soc. Rpt. 1895, pp. 68–162, figs. 96*).—A list is given of 148 species of insects known to attack the grape. Some 30 of the most injurious of these are described and figured with notes on their life histories. The methods found most successful in combating these insects are given.

Phylloxera of the vine: Treatment by means of carbon bisulphid, J. BRAHAMARY (*Des vignes phylloxérées: De leur traitement par le sulfure de carbone. Alger: Fontana & Co., 1898, pp. 12*).

Injurious insects of the forests of the Government of Kiev, S. TORSKI (*Selsk. Khoz. i Lyesov., 188 (1898), No. 2, pp. 413–428*).

Remedies for the destruction of insect pests, fungi, etc. (*California Bd. Hort. Rpt., 1895–96, pp. 56–63*).—Formulas and directions for the preparation of several insecticides and fungicides are given, with notes on other remedies.

Notes on some sawfly larvæ, especially the Xyelidæ, H. G. DYAR (*Canad. Ent., 30 (1898), No. 7, pp. 173–176*).

Classification of the horntails and sawflies or the suborder Phytophaga, W. H. ASHMEAD (*Canad. Ent., 30 (1898), No. 7, pp. 177–183*).—This, the second paper, takes up the series Xylophaga. In the family Oryssidæ 4 genera, Chalinus, Ophrynopus, Mocsarya, and Oryssus are recognized: in the family Siricidæ, the subfamilies Siricinæ and Tremecinæ and the genera Sirex and Paururus of the first and Xeris, Teredon, and Tremex of the second subfamily. In the family Xiphydriidæ 2 subfamilies, Derecyotinæ with the single genus Derecyrta, and Xiphydriinæ with 4 genera, Brachyxiphus, Philippi, Xiphydria, and Konowia; and in the remaining family, Cephidæ, the genera Cænocephus, Pachycephus, Syrista, Macrocephus, Calamenta, Astatus, Cephus, Trachelus, Monoplopus, and Ateuchopus.

A new species, *Cephus grænicheri*, from Wisconsin, is described.

The described species of Xiphidium in the United States and Canada, S. H. SCUDDER (*Canad. Ent., 30 (1898), No. 7, pp. 183, 184*).—A key to 10 species of the genus.

Icerya purchasi, a new scale of orange, O. KLEIN (*Gartenflora, 47 (1898), No. 16, pp. 433–436, fig. 1*).

Insect pests and tree diseases (*California Bd. Hort. Rpt. 1895–96, pp. 23–32, pls. 5, fig. 1*).—Insects and tree diseases common in the Eastern States and in foreign countries and liable to be introduced into California are described and figured, with notes quoted from various entomological writers. A list of all vessels arriving in the State from July, 1894, to August, 1896, inclusive, is given, together with lists of plants contained on them and notes as to the disposition made of them at the quarantine offices.

Injurious insect pests found on trees and plants from foreign countries, A. CRAW (*California Bd. Hort. Rpt. 1895–96, pp. 33–55, pls. 6, figs. 6*).—Some 40 insects are described and figured.

A twig gall of pine caused by Phytoptus pini, C. VON TUBEUF (*Forstl. Naturw. Ztschr., 7 (1898), No. 7, pp. 252, 253, fig. 1*).

The fir-tree root louse (Phemphigus poschingeri), C. VON TUBEUF (*Forstl. Naturw. Ztschr., 7 (1898), No. 7, p. 251*).

Contributions to a monograph of coniferous plant lice, I, N. CHOLODKOVSKY (*Horae Soc. Ent. Ross. [St. Petersburg], 31 (1898), pp. 78, figs. 36; abs. in Zool. Centbl., 5 (1898), No. 16, pp. 527–530*).—This paper treats of the species of Lachnus, of which 6 species frequent the pine, 7 are reported from the spruce, 3 from the fir, 3 from the larch, 2 from the juniper, and 1 from the cypress.

The life history of Lyda stellata and L. erythrocephala, K. SAJÓ (*Forstl. Naturw. Ztschr., 7 (1898), No. 7, pp. 237–247*).

Colorado Lepidoptera, C. P. GILLETTE (*Colorado Sta. Bul. 43, pp. 3–22, fig. 1*).—This is a list of Lepidoptera collected in Colorado, with brief notes on dates and localities of capture, names of collectors, food habits, etc.

The story of the lives of a butterfly and a moth, F. M. WEBSTER (*Ohio Sta. Bul. 86, pp. 25–33, figs. 6*).—The bulletin is intended for the young, especially school children, and gives something of the form and life history of a common moth and butterfly.

Insecticides: Their preparation and use, W. E. BRITTON (*Connecticut State Sta. Bul. 126, pp. 3–12, figs. 3*).—The bulletin gives a popular account of the following insecticides and directions for their preparation: *Internal poisons.*—Paris green, London purple, arsenate of lead, and hellebore. *Contact poisons.*—Whale-oil soap, kerosene, kerosene emulsion, kerosene and water, fir-tree oil, tobacco, and pyrethrum. *Poisonous and suffocating fumes.*—Tobacco fumes, hydrocyanic gas, and carbon bisulphid. A list of plants is given, together with a list of the insects most commonly attacking them and notes on the remedies to be employed in each case.

Spray calendar, L. C. CORBETT (*West Virginia Sta., folio*).—This gives tabulated directions for the treatment of a large number of insect pests and diseases, with formulas and directions for the preparation of several fungicides and insecticides.

Paris green, G. W. SHAW and J. F. FULTON (*Oregon Sta. Bul. 49, pp. 3*).—The bulletin discusses briefly the composition of Paris green, adulteration and its detection, etc. Analyses of 18 samples of Paris green are reported.

Reports of the quarantine officer and entomologist, A. CRAW (*California Bd. Hort. Rpt. 1895–96, pp. 127–135*).—A summary of the work of the quarantine officer and entomologist from April, 1895, to May, 1896.

Recent laws against injurious insects in North America together with laws relative to foul brood, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 13, n. s., pp. 68*).—This is a compilation of laws relating to injurious insects and foul brood in North America, together with some proposed National and State legislation.

FOODS—ANIMAL PRODUCTION.

On wheat and rye bread with special reference to the question of army bread, H. PODA, with preface by W. PRAUSNITZ (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 7, pp. 122–190, figs. 2*).—Experiments are reported on the digestibility of white wheat bread and rye bread with 4 healthy men ranging from 19 to 26 years of age. The bread was consumed with butter, wine, and sugar. Special attention was given to the preparation of the bread. The best sort of flour was used, but, according to the author, as shown by microscopic examination wheat could not be as finely ground as rye. The coefficients of digestibility of the 2 sorts of bread in the different experiments are shown in the following table:

Comparison of the digestibility of white-wheat bread and rye bread.

Subject.	Food consumed per day.	Coefficients of digestibility. Dry matter.	Organic matter.	Nitrogen.	Ether extract.	Ash.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Medical student V..	Rye bread 1,903 gm., butter 247.5 gm., wine 2,250 gm., sugar 45 gm.	94.47	94.92	65.20	94.47	68.21
Medical student S..	Rye bread 1,820 gm., butter 251.5 gm., wine 2,250 gm., sugar 45 gm.	94.37	94.75	63.82	93.94	70.05
Medical student V..	White bread 1,956 gm., butter 245 gm., wine 2,250 gm., sugar 45 gm.	96.47	96.82	83.15	96.40	71.72
Law student P......	Rye bread 1,285 gm., butter 240 gm., wine 1,500 gm., sugar 30 gm.	94.97	95.52	68.10	95.05	62.94
Mechanic G.........	Rye bread 2,076 gm., butter 250 gm., wine 500 gm., sugar 45 gm.	95.78	96.24	74.67	95.25	67.50
Law student P......	White bread 1,275 gm., butter 213 gm., wine 1,500 gm., sugar 30 gm.	96.57	97.02	84.62	97.41	66.34
Mechanic G.........	White bread 1,370 gm., butter 212 gm., wine 500 gm., sugar 30 gm.	96.26	96.76	83.21	96.04	69.33

The following conclusions were reached: When rye bread is eaten more feces are excreted and the percentage of nitrogenous material in the feces is larger than when wheat bread is eaten. In other words, rye bread is not as well digested as wheat bread. When thoroughness of digestion is an object the cheaper sorts of wheat flour should be substituted for rye flour. The bread supplied to some of the regiments of the German army is made of a mixture of rye and wheat flour, and this practice should be extended.

The article contains considerable controversial matter. The authors object to the deductions of Plagge and Lebbin (E. S. R., 9, p. 872).

Report of a practical test of the use of the emergency ration by United States troops on active service, C. SMART (*Com. Gen. Subsist. U. S. Army Rpt. 1897, pp. 12-19*).—Two tests were made of the emergency ration of the United States Army with cavalry soldiers near Fort Sill, Oklahoma. In one test 46 officers and men, averaging 158 lbs. in weight, were given the emergency ration for 10 days. The ration consisted of 12 oz. bacon, 11.2 oz. hard bread, 5.4 oz. flour, 2.4 oz. beans, 1.2 oz. sugar, 16 oz. potatoes, and some coffee, salt, and pepper. A portion of the food was not eaten. The average quantity consumed per man per day was 10.2 oz. bacon, 11.2 oz. hard bread, 2.2 oz. flour, 0.8 oz. beans, 16 oz. potatoes, and 0.95 oz. sugar. This was calculated to furnish 3.32 oz. protein, 7.68 oz. fat, and 15 oz. carbohydrates with a fuel value of 4,145 calories. The average loss in weight per man was 1.35 lbs.

The special emergency ration was tested with 10 men. This consisted of 8 oz. hard bread, 5 oz. bacon, 2 oz. pea meal, with coffee, saccharin, salt, pepper, and tobacco.

During a 10 days' test the men marched on an average 21 miles a day, and lost 2.935 lbs. in weight. They remained in good health and spirits. All the ration was consumed. It was calculated that it furnished 2.128 oz. protein, 3.809 oz. fat, and 6.93 oz. carbohydrates and yielded 2,055 calories.

The chemical composition and nutritive value of some edible American fungi, L. B. MENDEL (*Amer. Jour. Physiol., 1 (1898), No. 11, pp. 225-238*).—To determine their nutritive value a number of edible fungi were analyzed and their digestibility determined by methods of artificial digestion.

The composition of the different fungi examined is shown in the following:

Composition of various edible fungi.

	Water.	In dry substance.						
		Total nitrogen.	Albuminoid nitrogen.	Nonalbuminoid nitrogen.	Fat.	Soluble carbohydrates.	Crude fiber.	Ash.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Shaggy coprinus (*Coprinus comatus*)	92.19	5.79	1.92	3.87	3.3	18.0[1]	7.3	12.5
Inky coprinus (*C. atrimentarius*)[2]	92.31	4.68			3.1		9.3	16.8
Inky coprinus (*C. atrimentarius*)[3]	94.42	4.77			5.7			20.1
Common morel (*Morchella esculenta*)[3]	89.54	4.66	3.49	1.17	4.8	15.3[1]	8.7	10.4
Common morel (*M. esculenta*)[2]	91.24	5.36			7.5		9.5	13.6
Common mushroom (*Agaricus campestris*)	87.88	4.42						11.66
Common mushroom (*A. campestris*)	92.20	4.92						17.18
Sulphury polyporus (*Polyporus sulphureus*)	70.80	3.29	2.23	1.06	3.2	12.2[1]	3.0	7.3
Oyster mushroom (*Pleurotus ostreatus*)	73.70	2.40	1.13	1.27	1.6	18.6[1]	7 5	6.1
Smeared cortinarius (*Cortinarius cortinarius*)	91.13	3.63						
Clytocybe multiceps, entire	93.49	5.36	1.98	3.38	6.0		9.6	11.5
Clytocybe multiceps, stem	94.07	3.92						12.98
Clytocybe multiceps, pileus	92.68	5.84						10.82
Hypholoma condolleanum[3]	88.97	4.28	2.49	1.79	2.5		12.1	13.9
Hypholoma condolleanum[2]	91 97	4.44						19.9
Fairy ring mushroom (*Marasmius oreades*)	74.96	5.97						7.23

[1] Calculated as dextrose. [2] Young small specimens. [3] Full-grown specimens.

The variation in composition of different mushrooms is discussed. Among the bases found in the ash were potassium, sodium, and sometimes calcium. Iron was always present. Sulphuric and phosphoric acids predominated and chlorin was occasionally found.

The dry material was first digested with pepsin and hydrochloric acid and afterwards with a solution of dog pancreas, a little chloroform being added to prevent fermentation and also thermolized extract of dry pancreas powder. The undigested residue was eventually removed and dried and the nitrogen in it determined.

The total digestible nitrogen was determined by subtracting the nitrogen in the undigested (insoluble) residue from the total nitrogen of the original substance.

The nitrogen in the undigested residue was also subtracted from the total albuminoid nitrogen, the difference multiplied by 6.25, in the author's opinion, representing the true digestible protein in the mushrooms

The results of the digestion experiments are summarized as follows:

Coefficients of digestibility of various species of edible fungi.

	Total undigestible material.	Nitrogen in undigestible material.	Proteid nitrogen.			Albuminoid nitrogen.		True digestible protein.
			In original substance.	Undigestible.	Digestible.	In original substance.	Digestible.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Shaggy mushroom	26.21	4.21	5.79	1.10	4.69	1.92	.82	5.12
Inky coprinus	28.16	2.79	4.68	.78	3.90	....	....	....
Common morel	49.42	4.16	4.66	2.05	2.61	3.49	1.44	9.00
Oyster mushroom	59.43	1.39	2.40	.82	1.58	1.13	.31	1.94
Sulphury polyporus	55.00	1.05	3.29	.58	2.71	2.23	1.65	10.31
Clitocybe multiceps	37.57	1.96	5.36	.73	4.63	1.98	1.25	7.81
Hypholoma candolleanum	31.98	3.63	4.28	1.16	3.12	2.49	1.33	8.31

The fact is pointed out that considering the high water content and the comparatively small amount of digestible protein which they contain, mushrooms do not have a high food value. In this respect they resemble ordinary vegetables and the term "vegetable beefsteak" which is often applied to them is very erroneous.

"The carbohydrate content of the fungi is relatively high; but until more is known regarding the nature and digestibility of the carbohydrate constituents of various vegetable foods, it will be useless to draw comparisons. As dietetic accessories the edible fungi may play an important part; but investigation has demonstrated that they can not be ranked with the essential foods."

Chemical composition and digestibility of edible fungi, M. STAHL-SCHRÖDER (*Selsk. Khoz. i Lyesov., 184* (*1897*), *Feb., pp. 437–446*).—This investigation includes analyses of several varieties of edible fungi, detailed analyses of the ash constituents, and digestion experiments with rabbits and by artificial digestion.

The composition of the edible fungi is shown in the following table:

Composition of edible fungi.

	Water.	Water-free substance.				
		Protein.	Albumin	Fat.	Carbohydrates.	Cellulose.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Boletus edulis	84.19	47.36	27.90	3.08	34.81	5.58
Agaricus deliciosus	89.98	31.66	21.41	6.16	51.04	3.60
Cantharellus cibarius	90.93	20.84	13.71	7.35	68.80	3.79

The ash constituents of the 3 varieties of edible fungi were as follows:

Composition of ash of water-free substance of edible fungi.

	Crude ash.	Sand.	Carbon dioxid.	Pure ash.	Sulphuric acid.	Silica.	Phosphoric acid.	Potassium and sodium oxids.	Iron, manganese, and aluminum oxids.	Calcium oxid.	Magnesium oxid.
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	Per ct.	Per ct.	P. ct.	P. ct.
Boletus edulis	9.17	0.15	0.21	8.81	1.24	0.05	2.18	4.39	0.19	0.34	0.21
Agaricus deliciosus	7.54	.05	.84	6.65	.18	.06	1.66	3.89	.08	.09	.14
Cantharellus cibarius	9.23	.04	1.74	7.44	1.10	.17	1.13	4.78	.34	.12	.18

It was found that from 15 to 19 per cent of the total protein could be extracted with water. Therefore when mushrooms are prepared for the table it is recommended that they be washed with small amounts of water.

For the digestion experiments the fungi were dried at low temperature and pulverized. They were mixed with water when fed. The rabbits were accustomed to the fungi by feeding them in increasing amounts with milk, sugar, and cocoanut cake. Three experiments are reported. In the first 20 gm. of *Agaricus deliciosus* was fed daily with water for 11 days. During the last 4 days the feces were analyzed. In the second test, which lasted 6 days, the rabbit received the same food as in the first with 8 gm. of sugar in addition. In the third test, which lasted 16 days, the rabbit was fed *Boletus edulis* with sugar. Tests were attempted with *Cantharellus cibarius*, but the rabbit would not eat this even with sugar. The first rabbit weighed 1,421 gm. at the beginning and lost 36 gm. daily, the second weighed 1,937 gm. and lost 23 gm. daily, and the third weighed 1,890 gm. and lost 10.2 gm. daily.

The results of the tests are shown in the following table:

Coefficients or digestibility of edible fungi.

	Dry matter.	Protein.	Fat.	Carbohydrates.	Crude fiber.	Ash.	Albumin.	Amid nitrogen.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Rabbit 1	63.2	70.9	81.7	62.7	....	51.1	60.5	90.2
Rabbit 2	72.3	75.3	94.3	72.2	....	75.3	81.1	89.4
Rabbit 3	84.9	83.8	74.2	88.7	85.6	85.6	83.8	89.8

The addition of sugar increased the digestibility of the edible fungi.

The 3 varieties of edible fungi were digested with pepsin and pancreas according to Stutzer's method. It was found that 86 per cent of the Boletus was digested, 69 per cent of the Agaricus, and 58 per cent of the Cantharellus, while the coefficients by actual digestion experiments were 84.4, 70.9, and 75.3 per cent, respectively.

The author compares mushrooms with other food materials and believes that some of the earlier investigators have underestimated their food value.—P. FIREMAN.

Experiments on the nutritive value of alfalfa, A. MÜNTZ and A. C. GIRARD (*Ann. Agron., 24 (1898), No. 1, pp. 5–39*).—The authors made an extended study of the composition of alfalfa. Experiments were made with 4 horses to determine the digestibility of alfalfa (green and cured) fed alone and of a mixture of alfalfa and meadow hay. In experiments 1, 2, 5, and 6 the effect of feeding equal and unequal quantities of hay was also studied. The digestion experiments were usually of 21 days' duration. The coefficients of digestibility of the different rations fed are shown in the following table:

Results of digestion experiments with horses.

Number of experiment.		Daily ration.	Coefficients of digestibility.							
			Protein.	Albuminoid nitrogen.	Material soluble in alcohol.	Material soluble in water.	Saccharifiable substances.	Sugar.	Crude fiber.	Undetermined substances.
			Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	Horse 1	10 kg. alfalfa hay	74.2	73.5	74.3	78.5	57.7	......	24.4	61.7
	Horse 2	do	76.5	74.3	70.6	78.6	72.7	......	25.4	61.1
2	Horse 1	12.5 kg. alfalfa hay	72.8	70.2	76.7	78.4	68.1	......	31.3	61.3
	Horse 2	8.5 kg. alfalfa hay	75.3	73.6	76.7	78.4	61.4	......	36.9	64.7
3	Horse 2	12 kg. alfalfa stalks	72.6	66.8	82.4	78.2	45.2	......	40.3	58.8
4	Horse 2	8 kg. alfalfa leaves	75.5	75.6	79.9	84.5	75.8	......	52.1	71.2
5	Horse 1	10 kg. alfalfa and meadow hay.[a]	67.4	65.9	87.6	76.5	61.4	100	40.0	62.9
	Horse 2	do	66.8	65.4	86.0	74.6	69.3	100	45.3	67.9
6	Horse 1	12.5 kg. alfalfa and meadow hay.	65.1	57.1	85.9	73.1	52.5	100	32.3	64.5
	Horse 2	8.5 kg. alfalfa and meadow hay.	69.8	63.5	84.4	74.1	58.7	100	38.8	68.8
7	Horse 3	40 kg. alfalfa (green)	75.2	72.4	89.1	92.2	62.5	100	46.0	75.4
	Horse 4	do	81.2	79.2	90.2	92.7	66.4	100	47.6	75.9
8	Horse 3	10.5 kg. alfalfa hay	73.0	63.9	89.1	89.0	68.5	100	61.7	53.9
	Horse 4	do	80.2	79.0	90.4	90.2	71.9	100	54.1	64.2

[a] The mixed hay was composed of 68 per cent alfalfa and 32 per cent grasses.

The authors conclude that as regards nitrogenous material alfalfa is superior to meadow hay; as regards carbohydrates hay is superior. According to statistics for 1895 alfalfa furnished 162 kg. more digestible nitrogenous material per hectare than wild meadow hay. In addition the alfalfa fixes atmospheric nitrogen, while the grasses do not.

Investigation on molasses in different forms for fattening lambs, F. ALBERT (*Landw. Jahrb., 27 (1898), No. 1–2, pp. 208–214*).—A test to compare different methods of feeding molasses was made with 4 lots of 15 lambs each. The test began June 22, 1896, and covered 206 days.

The average weight at the beginning was 30.58 kg. One lamb was dropped from the test before the close. All the lambs received a basal ration per 1,000 kg. live weight of 8 kg. alfalfa hay, 8 kg. straw and chaff, 6 kg. dried beet chips, and 5½ lbs. rape-seed cake. In addition, lot 1 was fed 1½ kg. molasses and 4½ kg. bran: lot 2, 9 kg. molasses bran; lot 3, 1½ kg. wheat bran and 6.69 kg. molasses peat (containing 4½ kg. molasses); and lot 4, 4½ kg. wheat bran and 11.15 kg. molasses peat (containing 7½ kg. molasses). In the case of lot 1 the molasses was either given in the drinking water or mixed with some other food. In the other cases a mixed molasses feed was used. All the rations furnished 3.49 kg. digestible protein; the first 3 furnished 16.05 kg. nitrogen-free material, and the last 18.21 kg. The cost of the rations for the different lots was as follows: Lot 1, \$52; lot 2, \$54; lot 3, \$53.15; and lot 4, \$55.86. The average gains for the corresponding lots were 268.5, 288.5, 278.5, and 286.5 kg.

The principal conclusions reached were the following: Molasses can be regarded as a rational feeding stuff for fattening lambs. The feeding value of molasses not mixed with other material is slightly less than that of the mixed molasses feeds. Molasses peat and molasses bran have the same food value, but (at current prices) the molasses-peat ration was somewhat cheaper. In the rations tested increasing the nitrogen-free material by the addition of a large amount of molasses was not profitable. The author discusses the financial returns with and without the value of the manure.

Influence of different protein compounds on the gain of flesh in swine, O. HAGEMANN (*Milch. Ztg., 26 (1897), No. 48, pp. 762-764*).—The author calls attention to the fact that myosin (the chief nitrogenous constituent of flesh) contains 16 per cent of nitrogen, while the nitrogen content of the proteids in feeding stuffs varies, being, for instance, 18.2 per cent in case of peanut cake. In the author's opinion myosin can not be formed from the excess of nitrogen in proteids over 16 per cent. A method is proposed for calculating the amount of available protein in different feeding stuffs. Few details are, however, given.

Experiments were made with 8 pigs. From the time they were 8 weeks old until the beginning of the test proper the pigs were fed barley meal, consuming on an average during the 12 days 644 gm. and gaining 61 gm. in weight daily. The pigs were then divided into 4 lots of 2 each. Lot 1 was fed meat meal and potatoes; lot 2, corn meal and later ground oats; lot 3, barley meal; and lot 4, peanut cake and potatoes. In addition, all the lots were given salt, calcium phosphate, magnesium phosphate, and potassium chlorid, the amounts being in such proportion that the ash content of the different feeding stuffs was equalized. The amounts of food consumed, the nutritive ingredients, the total nutritive material, the nutritive ratio, and the gains in weight are recorded for the whole experiment, which lasted from August 14 to January 31. The total nutritive material was found by adding together

the protein, nitrogen-free extract, and fat multiplied by 2.5. The digestible nutrients consumed per day were calculated. The amount of digestible protein and total digestible nutritive material consumed per day and the gain in weight per gram of nutritive material in the several rations are shown in the following table:

Results of pig-feeding experiments.

	Food consumed.		Gain in weight per gram of nutritive material.
	Digestible protein.	Digestible nutritive material.	
	Grams.	*Grams.*	*Gram.*
Oats	157.2	1,278.7	0.3125
Meat meal	158.6	1,032.2	.2887
Peanut meal	156.9	1,074.1	.2374
Barley meal	153.9	1,081.4	.2387

The greatest gains were obtained with the oats. Of the other materials the total nutritive material consumed and the gain made was largest in the case of meat meal. Barley meal and peanut cake and potatoes were practically equal.

The pigs were slaughtered. The flesh of all the lots was of good quality and no differences were observed. This is of interest, since the opinion is more or less prevalent that the flesh produced by meat meal is of inferior quality. The author believes that if this is true it is due to the fact that the proper mineral salts are not fed with the meat meal. Meat meal contains an excessive amount of potassium salts. These are eliminated from the body and, it is said, remove considerable quantities of phosphoric acid and sodium. Therefore a corresponding amount of sodium chlorid and phosphoric acid salts should be supplied with the food.

Salicylic acid and calcium sulphite as preservatives of ciders, E. H. S. BAILEY and C. M. PALMER (*Kansas Univ. Quart., 6 (1897), pp. 111–116*).

Observations on the nutritive value of "integral" whole-wheat bread, G. ALBINI (*Rend. Acad. Sci. Fis. e Math., 3. ser., 4 (1898), No. 3–4, pp. 117–120*).—The author quotes at length the experiments of Pagliani and C. Mazza[1] on the digestibility of the so-called integral whole-wheat bread, made by Desgoffe and Avedyk's method without grinding the grain. It is believed that the results indicate that while the bread can be recommended on account of its price it is not a suitable article of diet on account of its inferior digestibility.

"Integral" whole-wheat bread, A. CELLI (*Uffic. Sanit., 11 (1898), No. 3, pp. 121–127*).—The composition of bread made directly from grain without grinding (according to Desgoffe and Avedyk's method) is reported as follows: Water, 46.30 per cent; protein, 13.88 to 14.22; fat, 1.11 to 2.39; starch, 77.12 to 77.32; crude fiber, 2.6 to 3.12; ash, 3.49 to 3.85; and acid, 1.8 to 2.1 per cent. The author considers the bread inferior on the basis of composition, physical properties, indigestibility, and lack of keeping qualities.

Feeding stuff inspection, C. D. WOODS (*Maine Sta. Bul. 44, pp. 16*).—In compliance with the Maine feeding-stuff law determinations were made of the protein and

[1] La panification integrale col sistema Antispere (Desgoffe et Avedyk), Torino, 1898.

fat in a number of samples of cotton-seed meal, linseed meal, gluten meal, gluten feed, oat feed, meat meal, meat scrap, and mixed feeds. The law is regarded as successful, and statements are made concerning its operation.

Report of the dairy and food commissioner, L. WELLS (*Pennsylvania Dept. Agr. Bul. 34, pp. 108-118*).—A report is given showing the satisfactory working of the pure-food law in Pennsylvania. The subject is discussed chiefly from a legal standpoint.

Data on the growth of young stock, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 72, pp. 175-180*).—Notes are given on the growth of the young cattle in the station herd during the winter of 1897. The amounts of food consumed and gains made by 12 Shorthorns, 4 Holstein-Friesians, 3 Herefords, and 5 Jerseys are recorded. No conclusions are drawn from the work.

DAIRY FARMING—DAIRYING.

Investigations on the composition of colostrum with special reference to the proteids, H. TIEMANN (*Ztschr. Physiol. Chem., 25 (1898), No. 5-6, pp. 363-392*).—Analyses are tabulated of the colostrum from the first 3 milkings of 2 Angler, 1 Breitenburger, 1 Shorthorn-Dithmarsch, and 2 native cows. The methods employed are described, and, incidentally, a comparison is given of the Wollney refractometer with gravimetric analysis for fat.

The results show that the colostrum of different cows varies widely in composition. The solids ranged from 12.83 to 32.93 per cent, decreasing from one milking to another, while the water increased. The greatest variation was found in the fat, which ranged from 0.56 to 9.28 per cent. The total proteids varied from 13.25 to 21.76 per cent for the first milking, from 7.74 to 15.80 for the second, and from 4.66 to 12.06 for the third, thus decreasing rapidly from milking to milking. The sugar content, on the other hand, increased, varying from 1.63 to 2.92 in the first milking, from 2.37 to 3.88 in the second, and from 2.74 to 4.39 in the third. The ash showed little change from one milking to another. Comparing the results with those given by others, the author concludes that breed has little to do with the composition of colostrum, but that it is a matter of individuality.

Most of the paper is devoted to the proteids of colostrum. The literature of the subject is reviewed, showing the prevalence of a diversity of views on the nature of the proteids, some investigators asserting the absence of casein and that only albumen is present, while others claim that both casein and albumen are present, although they differ considerably as to the relative amounts of the two. Sebelin[1] and Emmerling[2] have also reported the presence of a globulin in colostrum.

The author's investigations were made on colostrum from the first 3 milkings of the cows mentioned above. Separations were made by means of the porous plate and by various chemical means. He concludes that the content of total proteids differs widely and dimin-

[1] Ztschr. Physiol. Chem., 13 (1889), p. 171.

[2] Centbl. Agr. Chem., 17 (1888), p. 861.

ishes from milking to milking. The undissolved albuminoids (those in suspension) are 10 to 30 times and in some cases 100 times as great in amount as those in solution.

The undissolved albuminoids decrease regularly, while the dissolved albuminoids show less variation and usually increase in amount. Assuming the proteid in solution to be albumin, the amount found in colostrum was approximately the same as that present in normal milk, and this was borne out by direct determinations of the albumin.

Both the casein and globulin are present in colostrum in suspension, i. e., not in solution. The casein was usually within the limits for normal milk, although sometimes slightly greater. The globulin content was invariably in excess of the casein, being from 2 to 4 times as great. The curdling which takes place on heating colostrum is principally due to the globulin, which coagulates at 72° C. Analyses of the preparations of the globulin showed it to contain 49.83 per cent of carbon, 7.77 of hydrogen, 15.28 of nitrogen, 1.24 of sulphur, and 25.88 of oxygen, from which the author concludes that it is not identical with any known albuminoid. It is soluble in dilute acetic acid and dilute salt solution, is coagulated from the same by heat, and is precipitated from a dilute salt solution by saturation with salt, showing it to be a globulin-like substance. Hence the author proposes to call it colostrum globulin. The marked difference in composition between it and blood globulin indicates that blood globulin, like most other constituents of the blood, does not pass into the colostrum in its original form but is materially altered in the lacteal glands.

Goats' milk and goats' colostrum, R. STEINEGGER (*Schweizer Bauer; abs. in Milch Ztg., 27 (1898), No. 23, pp. 356–358*).—A study of the normal milk and especially the colostrum of goats, made at the dairy school at Rütti. The normal milk of goats of the region was found to contain: Water, 88.42 per cent; fat, 3.25; albuminoids, 3.92; milk sugar, 2.80; and ash, 0.63.

It is stated that the colostrum varies greatly with individuals of the same breed. Some goats give no real colostrum and others only a very little. Analyses are given of the milk of a goat with her first kid, showing that there was practically no change in composition during the first 4 days after parturition. "The milk was entirely normal from the first, and there was no true colostrum." The third milking of another goat showed colostrum bodies under the microscope, and was high in fat (6.1 per cent). The first milk of an older goat did not have the composition of colostrum, although the acidity was high; but that from the second milking contained 16.85 per cent of fat; the next day it had fallen to 4.2, and 2 days later was normal.

Concerning the composition of milk produced in the vicinity of Giessen, T. GÜNTHER (*Milch Ztg., 27 (1898), No. 29, pp. 453, 454*).—In a study of the milk supply of Giessen, Germany, the author analyzed the milk from 130 producers, representing the milk of 441 cows. The

samples were taken in August and September and in March and April. The range and the average composition of the 130 samples of milk were as follows:

Composition of milk sold in Giessen.

	Range.		Average composition.
Specific gravity	1.0277 to	1.0345	1.03086
Total solids ... per cent	11.3	15.0	12.55
Fat ... do	2.6	5.8	3.83
Solids-not-fat ... do	7.9	9.9	8.72
Fat content of solids ... do	22.6	40.2	30.52

The fat content was 3.5 per cent or over in more than two-thirds of the cases and 4 per cent or over in 35 per cent of the cases. On the basis of the investigation, a specific gravity ot from 1.028 to 1.0345 and a fat content of 3 per cent are recommended as the milk standard for whole milk for the city.

Abstract of the report of the experiment station and school at Kleinhof-Tapiau for 1897–98 (*Milch Ztg., 27* (*1898*), *No. 32, pp. 500–502*).—Among other things the report contains the results of a test of Wollny's refractometer and the Gerber and Babcock milk tests. The results of the examination of the milk of the Kleinhof-Tapiau herd from 1889 to 1897 (E. S. R., 7, p. 50) are briefly discussed in the abstract, and a summary is given for the year ending September 30, 1897. Data are given as to the yield of different kinds of cheese from whole milk and from skim milk, the losses in ripening different kinds of cheese, etc.

A method for distinguishing pasteurized and unpasteurized milk, V. STORCH (*40. Bericht des Versuchslaboratoriums der Kgl. Veterinär- und Landbauhochschule. Copenhagen: A. Bang, 1898; abs. in Milch Ztg., 27* (*1898*), *No. 24, pp. 374, 375*).—In Denmark the laws for the suppression of tuberculosis forbids the selling of skim milk or buttermilk which has not been heated to at least 85° C. It was for the execution of this law that Professor Storch devised his method. The method is based upon Babcock's discovery that the fibrin of milk decomposes hydrogen peroxid, that cream is more active in this respect than whole milk, that skim milk is less active, and furthermore that milk heated to 100° loses this property. Storch found that milk retained its property of reducing hydrogen peroxid up to 79° C. As an indicator of the reduction he uses paraphenylendiamin.

The hydrogen peroxid solution is made by diluting the commercial article (when it contains 1 per cent of the material) with 5 times its volume of water and adding 1 cc. of concentrated sulphuric acid per liter. In making the test a teaspoonful of the milk (cream or whey) is shaken in a test tube with a drop of the peroxid solution and 2 drops of the paraphenylendiamin solution. If the milk colors immediately (milk or cream, indigo blue; whey, violet red brown) it has not been heated to 78° C., and in fact has not been heated at all. If the milk or cream becomes grayish blue immediately or in half a minute, the indi-

cation is that it has been heated to 79 or 80°, and if it retains its original white color or is colored only slightly violet red it has been heated to more than 80°.

In testing sour buttermilk a teaspoonful is neutralized with lime-water and then the peroxid and indicator added. If the mixture turns blue the indication is that the cream from which the buttermilk originated was not heated to 80° C., but if no color appears it has been heated to 80° or more.

In testing butter about 25 gm. is melted in warm water, the clear butter fat poured off, and the milky residue adulterated with a like volume of water. The mixture is then tested in the same way as milk. If a blue color appears the conclusion is that the cream from which the butter was made was not heated to 80° C., but if there is no color or a weak violet brown color the butter was made from pasteurized cream.

Accompanying Storch's paper is a colored plate showing the colors of the reactions with pasteurized and unpasteurized milk, cream, skim milk, and whey.

A new method of preserving milk, H. DE LAVALLÉE (*Abs. in Milch Ztg., 27 (1898), No. 30, p. 472*).—Directly after milking the milk is placed in a cooled vessel and treated to pure carbonic acid under pressure of 5 to 6 atmospheres for 4 or 5 hours. Following this it is treated to oxygen at 5 atmospheres for 5 hours. This treatment kills all the aerobic and anaerobic bacteria. The milk is transported in vessels containing oxygen under 2 atmospheres of pressure. These vessels may be made in the form of siphons. Milk treated in this way is said to retain all the properties of fresh milk and can be guaranteed to be entirely free from all diseased germs.

Factory tests for milk, S. M. BABCOCK, H. L. RUSSELL, and J. W. DECKER (*Wisconsin Sta. Bul. 67, pp. 20, figs. 6, pl. 1*).—The statement is made at the outset that "every cheese factory, whether conducted upon the relative value plan or not, should be equipped with suitable apparatus for determining the cheese value of milk, and no one should be considered competent to manage a factory unless he knows how to use such apparatus." The use of the milk tester and lactometer for determining the composition of milk is described, and attention is called to the fact that the cleanliness and bacteriological condition of the milk, which are frequently overlooked, are matters of no less importance in cheese making than the composition.

"If the milk contains micro-organisms that are capable of decomposing any of the cheese-producing substances or is impregnated with taints or obnoxious flavors that are absorbed from the animal or after the milk is drawn, then its theoretical value as based upon the nutritive worth of its various elements is diminished to a greater or less degree by the operation of this second factor. So far the value of milk has been entirely determined by its cheese-producing capacity, and the influence of biological factors (bacteria, etc.) upon the character of the product has been ignored. . . . The actual value of any milk may be materially modified by the presence of taints (actual or potential), and to detect these is a very necessary and essential part of the cheese maker's business."

The testing of milk by its taste and odor, the detection of foreign matter by allowing a sample to stand in a glass jar and observing the amount of sediment, and testing the acidity by Farrington's alkaline tablets (E. S. R., 6, p. 83; 8, p. 933) are discussed, as are also the use of the rennet test, the detection of antiseptics, and fermentation tests. Gerber's fermentation test, as a means of determining approximately the quality of milk, is described. The more important feature of the bulletin is the description of the Wisconsin curd test, which originated at the Wisconsin Dairy School in 1895. An illustrated description of this test and the method of conducting it and interpreting the results are given.

To make the test a fruit jar is filled half full of milk and set in a tub about half full of water sufficiently warm to raise the temperature of the milk to 98° F. When this temperature is reached 10 drops of rennet extract is added to the milk and the jar left undisturbed until the milk is curdled, when the curd is broken into small pieces by stirring with a case knife. The whey is poured off as soon as the curd settles, and this process is repeated at frequent intervals until the curd mats into a solid mass. The temperature of the surrounding water should be maintained from 6 to 8 hours, to favor the rapid development of the organisms in the curd.

"If the milk contains no deleterious bacteria, the curd when cut will present a firm, even texture. If gas-producing bacteria are present the texture of the curd will be more spongy, the cut surface showing a number of holes varying in size, depending upon the prevalence and gas-producing ability of the undesirable bacteria. . . . The conditions under which the curd test is conducted accelerate the fermentative action, so that a milk that might show no symptoms of gas formation until the cheese was on the shelf would be detected when subjected to the curd test. Milks that are sufficiently contaminated to produce floating curds will show a very spongy texture in the test in a few hours. No hard and fast rules can be given for the interpretation of the results of the curd test, but an ordinary operator will very quickly learn to discriminate between milks that should and should not be accepted. . . . It is also possible that taints may be produced by bacterial decomposition in cases where no gas is formed. This is particularly true with that class of organisms that act upon the albumen and casein instead of the milk sugar. Those bacteria that find their way into the milk through the introduction of filth and dust are particularly prone to produce this change, and this type of fermentation is very often found during the summer months. In the curd tests such milks are not condemned upon the texture of the curd, but upon the odor, which is more or less pronounced when the bottle is opened."

Besides the improvised apparatus for making the test an improved apparatus is described, consisting of a water box with a close-fitting cover which permits the retention of the desired temperature for a longer time, racks for holding the bottles, and bottles better suited to the purpose of the test than ordinary fruit jars. Such apparatus can now be obtained of some of the dairy supply houses.

In conclusion, several illustrations are given of the favorable results which have followed the use of the curd test in cheese factories. In one case where the cheese maker was troubled with tainted milk

and pin-holey curds the test showed that the bad milk could be traced to 6 different sources where carelessness prevailed in caring for the milk. The trouble was overcome when the fault was located. In another factory, where brick cheese was made and the quality of the product was so poor that the cheese had fallen off 3 cts. per pound in value, the curd test narrowed the trouble down to 3 cows that gave gassy milk. When the milk of these 3 cows was excluded the trouble disappeared at once. In another brick-cheese factory where similar trouble occurred "the curd test of each patron's milk revealed the fact that in 6 out of 28 cases bad milks were being brought to the factory." When the milk from these patrons was excluded good cheese was produced. An extract is given from the report of the traveling dairy instructor of the Wisconsin Dairymen's Association to the effect that the test "will locate tainted milk with unerring certainty," and "is simple, practical, reliable, and very convincing."

Contribution on rennet curdling, R. BENJAMIN (*Inaug. Diss., Berlin, pp. 32*).—The author made investigations on the action of rennet on the casein of milk in the presence of foreign substances or in the case of milk treated in different ways, the action of rennet to which chloroform was added, and the action of rennet on other animal and vegetable albuminoids.

Milk with an acid reaction curdled most rapidly, that with a neutral reaction more slowly, and a too strongly alkaline solution prevented curdling altogether. Milk to which chloroform was added curdled somewhat more slowly, and milk diluted with water even more slowly. Boiled milk refused to curdle with a strong rennet solution, but was curdled by rennet powder in 5 minutes. It was found impossible to curdle sterilized milk by any means. The addition of chloroform in very small quantities in making up the rennet solution was found to increase the curdling action of the rennet, while large quantities diminished it. No animal or vegetable albuminoid, except the casein of milk, was found to be acted upon by rennet. All solutions of casein which curdled with rennet were found, like milk, to be alkaline toward lacmoid and acid toward phenolphthalein; and casein solutions were not curdled except in the presence of soluble lime salts.

Further contributions on milk hygiene, OTT (*Ztschr. Fleisch- u. Milchhyg., 8, No. 4, pp. 69–71*).—The author discusses the danger of infection with tuberculosis from using raw milk. Forty-three samples of market milk were examined for tubercle bacilli by treating 25 cc. of milk with 2 cc. of caustic ammonia and 100 cc. of a mixture of ether and petroleum ether in equal parts, removing the fat layer, and then treating the remainder of the solution in a centrifugal apparatus for 15 minutes. The sediment was then examined in the ordinary manner. Of the 43 samples of milk tested 5 were found to contain the bacilli, the number of bacilli in 4 cases being small.

To test the virulence of the bacilli guinea pigs were inoculated with

5 cc. of a mixture of the sediment and cream. Of 10 animals inoculated 7 became infected with tuberculosis. Fresh milk obtained from dealers was inoculated into 30 guinea pigs, with the result that 10 died, 4 dying from the effects of tuberculosis.

The author discusses the results as pointing to the danger of infection from tuberculosis, strongly advises sterilizing milk on a commercial scale and in the home, and points out the desirability of veterinary control of dairy herds. The testing of milk for disease germs is believed to be quite as important as the ordinary milk control in which the fat content or addition of water is determined. The author regrets the lack of a rapid and safe method by which tubercle bacilli can be detected in milk, making it practicable to exclude from sale milk containing the bacilli.

The recognition of tubercle bacilli in butter and milk (*Arb. K. Gesundheitsamte, 14, No. 1; abs. in Milch Ztg., 27 (1898), No. 35, pp. 551, 552*).—In the examination of 102 samples of butter, using guinea pigs for experimental animals, a new rod bacillus, very similar to the tubercle bacillus, was found. This bacillus, it is stated, might easily be mistaken for the tubercle bacillus, especially by an inexperienced observer. Of the 102 samples of butter, 17 contained tubercle bacilli alone, 16 contained tubercle bacilli and the new rod bacillus, 38 contained the new bacillus alone, and only 17 were free from both bacilli.

The new bacilli did not cause sickness in guinea pigs except when present in large quantities. The effect was more marked when the bacilli were taken with large quantities of butter, in which case the effect on the peritoneum was very similar to that produced by tubercle bacilli and butter, the animals dying in both cases with similar symptoms.

Of 64 samples of milk collected from milk wagons and dairy stores in Berlin, 9 contained tubercle bacilli, 4 contained the new bacillus, and 51 were free from either kind of bacilli. It is thought possible that the new bacillus may have been overlooked in some of the earlier samples examined.

Milk supply from a bacteriological standpoint, P. Ravenel (*Jour. Comp. Med., 1898, No. 4, pp. 215–221*).

On the ripening of cheese, J. Schivokich (*Ann. Inst. Pasteur, 12 (1898), No. 6, pp. 400, 401*).

Dairy department, E. E. Kaufman (*North Dakota Sta. Rpt. 1897, pp. 80, 81*).—A brief account of the work of the dairy department of the station.

On the fungus flora of Brie cheese, J. Constantin and J. Ray (*Compt. Rend. Soc. Biol., 1898, No. 16, pp. 504–507*).

Micro-organisms in the dairy, N. Bendixen (*Die Mikroorganismen im Molkereibetriebe. Berlin: 1897, pp. 44; abs. in Hyg. Rundschau, 8 (1898), No. 11, p. 548*).

The mechanical purifying of milk and apparatus for this purpose, A. Lavalle (*Milch Ztg., 27 (1898), No. 25, pp. 390–392, figs. 7; 26, pp. 405, 406, figs. 10; 27, pp. 417–419, figs. 5*).—The article describes various forms of centrifugals, strainers, filters, and apparatus for sedimentation for cleaning milk on a large and small scale.

Extracts from the report for 1897 of the Dairy Institute at Hameln (*Milch Ztg., 27 (1898), No. 23, pp. 354–356*).—Data are given as to the efficiency of separators, the losses in butter making, testing of skim milk by Gerber's apparatus, etc.

On iodin fat and its behavior in the body, H. Winternitz (*Ztschr. Physiol. Chem., 24 (1898), No. 5–6, pp. 425–448*).—Among other things experiments are reported with goats on the transmission of iodin fat in the food to the milk of the animal. When iodin fat was fed it was detected in the milk, being absorbed by the milk fat.

Asses' milk as a substitute for human milk, A. Schlossmann (*Abs. in Milch Ztg., 27 (1898), No. 25, p. 393*).—The variations in asses' milk, the relative proportions of its constituents as compared with human milk, and the nutrition of the child with asses' milk are considered.

The conditions of the production of richer milk, A. Kraemer (*Milch Ztg., 27 (1898), No. 26, pp. 402–404*).—A concise summary of the results of investigations relating to the effect of feeding and management on the yield and composition of milk.

Bacteriology in the dairy, E. von Freudenreich (*Jena: Gustav Fischer, 1898*).—This is a short popular treatise on this subject for the use of dairy schools, cheese makers, and farmers. The book is very favorably mentioned in Milch Zeitung, 27 (1898), No. 24, p. 378).

VETERINARY SCIENCE AND PRACTICE.

Cattle tick and Texas fever, W. H. Dalrymple, S. B. Staples, H. A. Morgan, and W. R. Dodson (*Louisiana Stas. Bul. 51, 2. ser., pp. 230–282, pls. 5, figs. 2*).—The widespread dissemination of Texas fever is pointed out and the symptoms of the disease are described in detail.

"A summary of the more diagnostic characters to be looked for when Texas fever is suspected would include:

"(1) Cattle ticks; (2) hæmoglobinuria, enlarged spleen, enlarged yellowish liver, thick flaky bile, extravasations on the outer and inner surface of the heart, and (3) reduction in the number of red corpuscles, thinness of the blood, and the tardiness with which it exudes from an incision."

The life history of the southern cattle tick is discussed at some length and a number of experiments on the condition of development of the tick and on the efficacy of serum treatment for cattle are reported. Following is the authors' summary:

"The development of the cattle tick is less rapid in winter than in summer. The period of incubation is influenced by cold, and egg fertility is destroyed by direct sunlight. Seed ticks are capable of living a considerable length of time without food; this period is less in summer than in winter. Seed ticks may endure cold down to 16° F., below which death takes place. The parasitic period of development of the tick is very much longer in winter than in summer. The cattle tick remains attached to animals from the seed-tick stage to adult condition; if removed from its host during this parasitic period it soon perishes. The adult female tick is more easily destroyed by rainfall and cold than any of the other stages. The conditions lessening the number of broods per season also aid hibernation. Clean pastures materially aid disinfection. Ticks will not exist upon alluvial pastures unless the pastures are constantly being reinfected by the importation of highland cattle. Pastures may be disinfected by removing all cattle from them for at least one year, as would be the case in a system of rotation of crops. Ticks may be removed from animals by the use of mineral oil, applied either with a sponge or rag, or by plunging animals into a vat containing water upon the surface of which floats a thin layer of oil. Herds may be improved by keeping an imported stock bull in a small disinfected pasture or in a stable. The offspring of this animal will either possess immunity from birth or acquire it very young. The injection of 2 cc. of serum for

each 100 lbs. of the animal's weight, given daily for 10 days before ticks are allowed to get on the cow; will not prevent the animal from taking Texas fever. The injection of a moderate amount of serum for 10 days, beginning the treatment about the time the animal becomes infested with ticks, does not prevent the development of Texas fever. The injection of a large quantity of serum after the fever has developed does not influence the temperature of the animal."

Acclimation fever, or Texas fever, J. C. ROBERT (*Mississippi Sta. Bul. 42, pp. 32, figs. 4*).—Texas fever is discussed and the fact pointed out that so far as is known the only natural means of infecting cattle with this disease is the cattle tick. The cattle tick is described at some length. Quarantine regulations against Texas fever and the value of dipping cattle are discussed at some length.

A number of experiments were made with blood serum as a preventive and cure for Texas fever. The serum used in the experiments was obtained from southern cows well covered with ticks. The blood was taken from the jugular vein and collected in sterilized jars. After standing for 36 hours on ice the serum was drawn off in sterilized glass bottles. A small amount of serum was also prepared from a southern cow free from ticks. Tests were made to determine the efficiency of inoculation (1) before shipping cattle South, (2) before shipping and after reaching the South, (3) using serum from cattle with and without ticks on them, (4) with serum from cows sick with Texas fever, and (5) with tick juice. The various experiments are described in detail.

"The results of the experiments indicate unmistakably that the blood serum inoculation as we practiced it had no effect either in preventing or curing Texas fever. Our experiments furnish us additional evidence, however, that the cattle tick is the agent for transmitting the disease, and that valuable breeding animals can be brought South at any time with little danger of contracting 'acclimation' fever, provided they are kept free from ticks by placing in uninfected inclosures. Such animals should be regularly and carefully examined for ticks and the legs and soft skin of the body occasionally oiled."

The author is of the opinion that there is no toxin produced by the Texas-fever germ.

The typhoid serum diagnosis, H. L. BOLLEY (*North Dakota Sta. Rpt. 1897, pp. 30-43, fig. 1*).—The author gives a popular account of the subject, briefly mentioning the work of a number of investigators. Original investigations are also reported on the effects of typhoid serum upon the bacilli, the variation in condition as affecting the reaction, the use of the reaction in water analyses, and the source of reaction serum for the last purpose. The effects of the serum upon bacilli as seen under the microscope are described in some detail.

Experiments made during 1895-96 on the bacterial content of milk in the udder are noted. The following conclusions were drawn: The number of germs in the same udder varies at different times. The number varies on the same day in the different teats of the same udder, and on the same date for different udders. The number of different species present is also found to vary, and there is little constancy of

species in common to a number of different cows. Some species when once in a particular teat tend to occupy it with considerable persistency. The species able to multiply within the milk passages appear for the most part to be of the lactic-acid producing type.

An investigation of the growth of germs of typhoid fever in milk, butter, and other food products is also briefly noted. The injection of cultures of typhoid germs in butter into the abdominal cavity of guinea pigs resulted in death with typical symptons and *post-mortem* characteristics of typhoid.

Larkspur poisoning of sheep, E. V. WILCOX (*Montana Sta. Bul. 15, pp. 37–51, pls. 3*).—Losses of stock by eating poisonous plants have been reported for many years in Montana. Such losses have been most frequent during May and June, but have been noted at other seasons. The poisoning has been attributed to various plants. The author investigated widespread cases of sheep poisoning, which occurred in May, 1897. About 2,000 yearling lambs were moved to a new grazing region and almost immediately several of the sheep were taken sick. In a few days the sickness became widespread and the mortality was very great. From *post-mortem* examination it was evident that death was due to asphyxia or oxygen starvation, as the result of some sedative poison which had paralyzed the respiratory centers of the nervous system and prevented the proper action of the lungs in the purification of the blood. In the stomach contents were found the leaves and roots of a species of larkspur (*Delphinium menziesii*). The plant was found to occur plentifully in certain portions of the range. It was confined to the banks of streams and was not found on the higher ground. It was noticed that the poisoning occurred after the sheep had been feeding along streams where the larkspur was abundant.

"The symptoms shown by sheep poisoned by larkspur have a general resemblance to those of aconite poisoning, but are somewhat different in several particulars. The first signs of the poisoning are a slight general stiffness and a straddling gait, especially of the hind legs. The stiffness becomes more and more pronounced until walking is quite difficult and evidently painful. Soon there are manifested various involuntary twitchings of the muscles of the legs and sides of the body. There is a loss of control or co-ordination of the muscles. There is ordinarily no increase in the quantity of the saliva, no dribbling of saliva from the mouth, no champing of the jaws or attempts at swallowing. The sheep manifest none of the mental disturbances frequently seen in cases of poisoning from other sources, as, for example, loco weed and lupine. There is no impairment of the special senses. The sheep seem to hear and see as well and as correctly as under normal conditions of health.

"No indications of any disturbances of the digestive functions are to be seen. The appetite remains good, and the sheep eat up to the very last. They were observed eating industriously during the intervals between the attacks of spasms which they have during the last stages.

"At first the frequency of the pulse and of the respiratory movements is lessened and the temperature is lowered. The pulse remains very weak, but in the later stages becomes very rapid, in some cases 130 per minute. Toward the last, also, the respiration is very shallow and rapid. During the final convulsions the respiration is sometimes 120 per minute, but so shallow that the air is simply pumped up and

down the windpipe. The air in the lungs is therefore not renewed and the animal dies by asphyxia or suffocation.

"As long as the sheep can stand on his feet, or walk, he keeps up with the herd as nearly as possible. The exercise, however, excites him, makes his respiration more rapid, and he has frequently to lie down for a moment and then get up and hobble along after the herd. The worst cases can thus easily be detected, since they straggle behind the rest of the herd.

"The later stages of the poisoning follow rather rapidly. The involuntary movements become more frequent and more severe. All four legs tremble and shake violently. In fact all the muscles of the body contract spasmodically until the animal totters over on his side and dies in the most violent spasms."

The similarity to aconite poisoning suggested the line of treatment followed. Bleeding gave no relief and lard given internally had no noticeable effect. When only small amounts of larkspur had been taken the administration of ammonia or alcohol was found to give good results. During the first stages 3 drams of ether given through the mouth had good effect and later $\frac{1}{2}$ dram of ether given hypodermically stimulated the action of the heart and respiration. The most effective remedy was hypodermic injections of a solution of atropine sulphate in camphor water (4 grains of atropine to 1 fluid ounce of camphor water). Doses of 40, 30, and 20 minims of the solution were used, equivalent to $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$ of a grain of atropine sulphate. The solution was injected in the region of the shoulder. The effect was almost immediate. With one exception all the sheep treated by this method recovered. In the later convulsive stages of poisoning, ammonia fumes under the nostrils proved beneficial.

"Care in the management of sheep after they are poisoned is quite as important as the giving of medicines. Sheep poisoned with larkspur should be kept as quiet as possible. A trifling fright or excitement may throw them into spasms, and thus result fatally. From the very first the poisoned sheep have considerable difficulty in keeping up with the rest of the herd. They have a stiff and trembling gait. It becomes necessary for them frequently to stop for a moment to rest. In this way they repeatedly fall behind the herd and then run to overtake it again. Thus their excitement is constantly increased until they fall down in spasms.

"As soon as the stiffness and straddling gait, which are the first symptoms of larkspur poisoning, are noticed, one or the other of two methods of procedure should be adopted. Either the whole band of sheep should be herded closely and prevented from moving as fast as it usually moves, or, what is perhaps still better, the poisoned sheep should be separated from the others and kept as quiet as may be."

The author reports 2 experiments with sheep in which chloroform and benzol extracts of larkspur were injected.

"After 15 minutes the lambs began to show symptoms of larkspur poisoning and at the end of 1 hour the symptoms were so plain and pronounced that it was considered useless to sacrifice the lambs to the experiment. Both were therefore given one-eighth of a grain of atropine, which, with the aid of a small dash of ammonia in the nostrils, counteracted the effects of the poison and the lambs recovered completely.

"These experiments are quite in accord with the conclusions reached in the field work, and furnish another strong piece of evidence to the correctness of those conclusions, not only as to the cause of the poisoning but as to remedies to be used."

According to the author 2 species of larkspur are found in Montana, *Delphinium menziesii* and *D. glaucum*. Both these species are described.

The gape disease of poultry, H. GARMAN (*Kentucky Sta. Bul. 70, pp. 107–112, pls. 2*).—The author discusses this disease of poultry, which is caused by the presence of the gapeworm (*Syngamus trachealis*) in the trachea or windpipe, and the remedies commonly employed.

An experiment was made to learn the cause of the disease. Twenty chickens were divided into 2 equal lots immediately after hatching. They were placed in pens separated by wire netting. In one case the pen had a raised floor and in the other case the chickens ran upon the ground. The 2 lots were fed corn meal mixed with water and scraps of bread, potato, and meat from the table, with a few oats in addition. The chickens running on the ground were also fed earthworms. At the beginning of the test 3 of the chickens running on the plank floor managed to get through the wire netting into the other pen and were allowed to remain there. One of the chickens in the pen without a floor died from an unknown cause at the beginning of the test. About 2 weeks after the trial began one of the chickens in the lot running on the ground was badly affected with gapes, and several others were slightly affected. Sooner or later all the chickens in this lot were affected with gapes and either died or were destroyed, while in the other lot there were no cases. The author concludes that the chickens acquired the gapeworms either from the ground or from the earthworms fed to them.

Earthworms a source of gapes in poultry, H. GARMAN (*Kentucky Sta. Bul. 71, pp. 71–73*).—In continuation of the above work a test was made with 6 chickens divided into 2 equal lots. They were kept in wooden cages with wire gauze sides. One lot received earthworms and the other cooked meat in addition to the regular ration. The earthworms were thoroughly washed to prevent the adherence of soil or gapeworms. The chickens fed earthworms became affected with gapes. One of the chickens in the lot fed meat died from a bowel trouble, but examination failed to reveal any gapeworms. The 2 remaining chickens in this lot were alive at the time the test was reported and had not shown any symptoms of the gapes.

The conclusion is reached that earthworms convey the gape disease to poultry, and the common practice of feeding them to young chickens is condemned.

The inspection of meats for animal parasites, C. W. STILES and A. HASSALL (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 19, pp. 161, figs. 124*).—The bulletin consists of three parts: (1) The flukes and tapeworms of cattle, sheep, and swine, with special reference to the inspection of meats, by C. W. Stiles; (2) compendium of the parasites arranged according to their hosts; and (3) bibliography of the more important works cited, by A. Hassall.

"Although the report is intended primarily for the use of the meat inspectors of this Bureau, it will be found of general interest to all sanitarians, since it treats of the communicability of certain parasites from animals to man, and suggests the necessary methods of prevention and treatment therefor. The bulletin will serve a useful purpose in disseminating knowledge of the precautions that are required to eradicate certain of the most important parasites affecting domesticated animals in this country—parasites which are a menace to the public health. There is no work in the English language covering the subjects of which it treats."

In describing the different animal parasites technical zoological details have for the most part been omitted, stress being placed upon the practical application of zoological knowledge to questions of public hygiene. The authors call attention to the fact that the most important parasites for American inspectors are the common liver fluke and the large American fluke (which are a serious menace to live stock), beef measles, pork measles, and Hydatids, all of which bear an important relation to diseases in man. As noted, the Hydatid disease is comparatively rare in this country, and methods should be taken at once to prevent its spread.

"By proper precautions at the abattoirs and slaughterhouses this dangerous parasite can be totally eradicated from the country. If these precautions are not carried out it will only be a question of time when this country will take its place with Germany and Australia in respect to the number of human lives sacrificed to a disease which has not yet gained much ground with us and can now be easily controlled."

A complete index adds to the value of the bulletin.

Special investigation of the so-called "new horse disease" in Maryland, S. S. BUCKLEY (*Maryland Sta. Bul. 53, pp. 110–114*).—The author identified a so-called new horse disease prevailing to a considerable extent in Worcester County, Maryland, as cerebro-spinal meningitis. The disease is described, and information on its cause, treatment, and prevention is summarized.

"On the first appearance of this disease upon a farm a complete change should be made in the food. All moldy grain or fodder should be rejected, and where possible wheat bran should form part of the ration.

"It is evident that in so severe and rapidly fatal a malady powerful agents must be used. Proper nursing is necessary for success. Without it medicines avail but little. Placing the animal in slings early acts very beneficially in preserving the strength and increases the chances of recovery. When there is any considerable degree of heat at the poll of the head we should resort to the constant application of cold water, crushed ice, or some cooling lotion (nitrate of potash and acetate of ammonium, each a teaspoonful to a gallon of water). In the early stages these tend to check the flow of blood to the brain, and therefore reduce pressure upon it. Among medicinal agents we have recourse to ergot, aconite, and belladonna. Nux vomica and strychnin seem to be capable of producing desirable effects. As all of these are extremely powerful and poisonous, they should be used where possible under the supervision of a veterinarian, so that their effects may be watched and their omissions ordered, if necessary. The appetite should be maintained with tempting foods and drink. Purgatives and bleeding are to be avoided, as they seem to prove disastrous after the symptoms have become fully established. When the crisis has been passed and the animal begins to take nourishment tonics containing quinin and nux vomica should be given."

Dehorning cows, G. M. GOWELL and F. L. RUSSELL (*Maine Sta. Bul. 41, pp. 8*).—The opinions of a number of investigators concerning dehorning cattle are quoted and the results reported of dehorning at the station with clippers, and in the case of calves by means of potash. Dehorning is recommended, and it is believed that cattle are more comfortable and may be more easily cared for without horns than with them. Other conclusions are the following:

"The best time to dehorn cattle is during cold weather when there will be no trouble from flies.

"To dehorn mature animals, clippers should be used that will remove the horn perfectly at a single stroke and in a moment of time. With suitable clippers properly used the operation is simple and very quickly performed. When it is skillfully performed, animals do not give evidence of great suffering as an effect of dehorning. The tissues injured in dehorning are not very well supplied with nerves and they are quickly cut through. Good evidence that dehorning is not very painful is the fact that cattle will resume feeding immediately after being operated on, and the yield of milk in cows is not perceptibly affected. Compared with castration of colts and calves, dehorning may be considered painless. . . .

"To prevent the growth of horns, calves under 3 weeks of age can have the embryo horns removed with one stroke of a sharp knife, or they can be treated with a caustic sufficiently powerful to destroy them."

Dehorning cattle, F. W. RANE and H. H. LAMSON (*New Hampshire Sta. Bul. 50, pp. 21–29, figs. 3*).—The bulletin consists of two articles: (1) Experience with the college herd, by F. W. Rane; and (2) preventing the growth of horns, by H. H. Lamson. A number of animals at the station were successfully dehorned. They regained their original vigor in a short time and the disposition of the herd was changed for the better. Concise directions for dehorning cattle are given. Preventing the growth of horns in calves by the use of caustic potash is described with considerable detail and the results of this method of treatment at the station are noted.

Veterinary department, J. H. WORST (*North Dakota Sta. Rpt. 1897, pp. 17–24*).—The report discusses experiments in the introduction of mallein, the effect of tuberculin upon the milk supply, blackleg, and the selection of cows for experimental purposes. In the author's opinion his experiments show forcibly that a reaction above 104° F. indicates the presence of glanders, a conclusion verified by *post-mortem* examinations. In the case of cows treated with tuberculin the milk yield was diminished 7.7 per cent; where they were not so treated it was diminished 11.4 per cent. Injected animals showed a loss of 7.9 of the total amount of butter fat, while those that were not injected showed a loss of 8.7 per cent.

The author states that experiments with blackleg have demonstrated that the disease can be eradicated by the employment of blackleg vaccine.

Bovine tuberculosis, P. FISCHER (*Kansas Sta. Bul. 79, pp. 81–109, figs. 5, dgms. 8*).—This is an extended discussion of bovine tuberculosis, its cause, symptoms, and treatment. The application of the tuberculin test to the college herd is reported in considerable detail.

Hog cholera and swine plague, W. E. A. WYMAN (*South Carolina Sta. Bul. 31, pp. 8*).—This is a popular summary of the subject, describing hog cholera and swine plague, with remedies and methods of prevention.

Anthrax: A study of national and of State legislation on this subject, A. T. NEALE (*Delaware Sta. Bul. 37, pp. 15*).—This contains the enactments of Congress relative to anthrax and a discussion of the State legislation on the subject now in force in Delaware.

Blackleg: Its nature, cause, and prevention, V. A. NÖRGAARD (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 23, pp. 12, figs. 2*).—This is a popular bulletin giving information as to the nature, symptoms, and treatment of the disease. The method of operating and the process of vaccination, care of utensils, and what animals should be vaccinated and the dose are brought out.

Second Annual Report of the State Veterinarian, E. P. NILES (*Virginia State Veterinarian Rpt. 1897, pp. 15*).—The bulletin includes the regulations concerning transportation of cattle in Virginia and the rules and regulations of the board of control of the agricultural experiment station for the extermination of contagious and communicable diseases among domestic animals. A proclamation of the Governor is quoted authorizing the establishment of live-stock quarantine lines, rules and regulations, and prescribing penalties for violating the same.

TECHNOLOGY.

Cane sugar and the process of its manufacture in Java, H. C. PRINSEN-GEERLIGS (*Manchester: J. Roberts & Sons, 1898, pp. VI + 79 + V, fig. 1*).

Wine making in Russia. III. Eastern Transcaucasus, M. BALLAS (*St. Petersburg: Department of Agriculture, 1897, pp. XV + 403; abs. in Selsk. Khoz. i Lyesor., 189 (1898), Apr., p. 229*).—Historical and statistical sketch.

Report of the Bessarabia Experiment Station for wine making (*Selsk. Khoz. i Lyesov., 188 (1898), Feb., pp. 327–331*).

Maladies of wine: Their cause and treatment, E. H. RAINFORD (*Queensland Agr. Jour., 3 (1898), No. 1, pp. 59–62*).

The preparation of flax in its relation to flax culture, I. ELTRICH (*Die Flachsbereitung in ihrer Beziehung zur Flachsbaufrage. Trautenau: I. Eltrich, 1898*).—A comparison of the different methods of preparing flax, with a special consideration of the expense incurred and the results obtained.

The manufacture of perfumes at Grasse, J. ROUCHÉ (*Jour. Hyg., 23 (1898), No. 1150, pp. 469–473*).—This article is condensed from a study of the subject by H. de Parville in La Nature.

AGRICULTURAL ENGINEERING.

State aid to road building in Minnesota, A. B. CHOATE (*U. S. Dept. Agr., Office of Road Inquiry Circ. 31, pp. 12, figs. 5*).—This circular points out the injustice of the present system of "taxing farm property to improve all country roads, and city property to improve only city roads," and discusses a scheme of road legislation, the essential features of which are embodied in a proposed amendment to the State constitution, by which—

"The legislature is authorized to establish a State road and bridge fund and provide for a State highway commission, whose members must serve without compensation, and which shall have general supervision of the expenditure of the State road and bridge fund. This amendment does not contemplate that the State shall actually construct any wagon roads, but that it shall contribute not to exceed one-

third of the cost of any road, the other two-thirds to be paid by the locality where the road is built. The actual construction of the road so built is to be under the immediate supervision of the local authorities, the State commission simply determining, in a general way, what the character of the road shall be, and requiring, before the State pays any money for the improvement, that the road shall be constructed according to plans which it has approved."

Historical review of the work preparatory to the outlining of a general law for the purposes of draining and irrigating land (*Selsk. Khoz. i Lyesov., 186* (*1897*), *Sept., pp. 481–554*).

Cultivation under artesian irrigation, C. H. GORMAN (*Agr. Gaz. New South Wales, 9* (*1898*), *pt. 5, pp. 535–537*).—A discussion of artesian irrigation and its possibilities.

Hydrotechnical works and agricultural investigations in the region of the Siberian railway (*Selsk. Khoz. i Lyesov., 184* (*1897*), *Mar., pp. 481–502*).

Report of the provincial instructor in road making, Ontario, 1897, A. W. CAMPBELL (*Ontario Dept. Agr., Rpt. Provisional Instructor in Road Making 1897, pp. 71, pls. 8, figs. 10*).—This report contains articles on good roads—a national problem, country roads, and the good roads movement; municipal and county reports on roads and road making; report of the Brantford board of trade on the streets of that city; report on the streets of Guelph, Ontario; extracts from a report on streets to the city of St. John, New Brunswick; and notes on the frontage-tax system.

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Mississippi Station, 1897 (*Mississippi Sta. Rpt. 1897, pp. 23*).—Brief reports by the director and heads of departments, including the report of the chemist, noted on page 315, and a financial statement for the fiscal year ending June 30, 1897. Some results secured in the irrigation of strawberries and vegetables are briefly recorded in the report of the horticulturist.

Reports of director and treasurer of North Dakota Station, 1897 (*North Dakota Sta. Rpt. 1897, pp. 3–8, 82, 83*).—Brief report on the work of the year and a financial statement for the fiscal year ending June 30, 1897.

The world's markets for American products—Norway and Sweden (*U. S. Dept. Agr., Section of Foreign Markets Bul. 7, pp. 68, map 1; 8, pp. 92, map 1*).—Revised editions (E. S. R., 8, pp. 175, 637).

Crop circulars for July, August, and September, 1898, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circs. July, Aug., and Sept., pp. 4 each*).—These contain the usual data relative to conditions of farm and orchard crops during these months, with summarized temperature and rainfall records for the same periods, and a discussion of the foreign crop situation in the July and August reports.

Experiment Station Work—V (*U. S. Dept. Agr., Farmers' Bul. 78, pp. 31, figs. 2*).—The following popular articles appear in this number of the Office of Experiment Stations series of Farmers' Bulletins: Humus in soils; swamp, marsh, or muck soils; rape; velvet bean; sunflowers; winter protection of peach trees; subwatering in greenhouses; bacterial diseases of plants; and grape juice and sweet cider.

Experiment Station Work—VI (*U. S. Dept. Agr., Farmers' Bul. 79, pp. 28, figs. 2*).—The sixth bulletin of this popular series prepared in the Office of Experiment Stations. The following subjects are treated: Fraud in fertilizers, sugar-beet industry, seeding grass land, grafting apple trees, forest fires, American clover seed, mushrooms as food, pigs in stubble fields, ensiling potatoes, and anthrax.

Accessions to the Department library, April–June, 1898 (*U. S. Dept. Agr., Library Bul. 23, pp. 25*).

The Department of Agriculture and its work, G. W. HILL (*U. S. Dept. Agr., Division of Publications, Doc. 278, pp. 11, figs. 2*).—Brief notes on the organization of

the bureaus, offices, and divisions of this Department, with a diagram of the Department grounds in Washington, D. C.

Report of education committee on the results of the examination in agriculture, 1898 (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), pt. II, No. 34, pp. 377–387*).—An examination for the diploma in the science and practice of agriculture given by the Royal Agricultural Society of England. The subjects of the examination were agriculture, chemistry, bookkeeping, mensuration and land surveying, agricultural engineering, botany, geology, veterinary science, and agricultural entomology. The questions for each subject are given.

Agricultural monograph of the Department of Drôme, BRÉHERET (*Bul. Min. Agr. [France], 17 (1898), No. 4, pp. 811–867*).—This monograph discusses soil and climate, crops, animals, fertilizers and soil amendments, tillage, agricultural and associated industries, land improvements, rural economy, and encouragement to agriculture and agricultural education.

Agricultural monograph of the Department of Gironde, F. VASSILLIÈRE (*Bul. Min. Agr. [France], 17 (1898), No. 1, pp. 73–144*).—Discusses soil and climate, crops, animals, fertilizers and soil amendments, tillage, agricultural and associated industries, land improvements, rural economy, and encouragement to agriculture and agricultural education.

Tea districts of the subtropical regions of Asia, A. N. KRASNOV (*Pt. 1, Japan. St. Petersburg, 1897, pp. XXII+244, figs. 101, maps 2. Pt. 2, China, India, Ceylon, and Colchis. St. Petersburg, 1898, pp. 247+618, figs. 97. Rev. in Selsk. Khoz. i Lyesov., 189 (1898), May, p. 470*).

Proceedings of the fourth meeting of the Agricultural Council (*Selsk. Khoz. i Lyesov., 189 (1898), June, pp. 481+576; 190 (1898), July, pp. 1–88*).—Chiefly devoted to the elaborating of general statutes for agricultural schools.—P. FIREMAN.

The foundations of scientific agriculture, S. COOKE (*London, New York, and Bombay: Longmans, Green & Co., 1897, pp. 268, pl. 1, figs. 85*).—This is a text-book intended for use in the provincial schools and colleges of India, the larger part of which was originally prepared in the form of lectures for use in the instruction of students of agriculture, engineering, and forestry at the Poona College of Science. The subjects treated are air and water; sunshine, rain, and climate: rock-forming minerals; soil-forming rocks; soil-forming agencies; varieties, classification, composition, and analyses of soil; relation of plant food to the atmosphere and the soil—plant growth and architecture; nature and varieties of crops; manures for the soil and crops; the cultivator and his art; and measurements, etc. A glossary of terms and a series of examination questions are given, as well as appendixes containing a list of the stratified rocks of the British Isles, with their economic contents; an account of an experiment with manures prepared from street sweepings; and a discussion of the educational uses of famine.

The work is adapted especially to the needs of the Indian agriculturist, the illustrations of principles being drawn from the climatic soil, crop, and social and economic conditions which obtain in India.

A chapter of especial interest is that devoted to the characteristics and culture of Indian crops.

NOTES.

MARYLAND STATION.—C. O. Garner has been elected assistant agriculturist to succeed E. H. Brinkley, and C. F. Doane, a graduate of Kansas Agricultural College and post-graduate of Wisconsin University Dairy Department, has been appointed assistant in dairying and dairy bacteriology. A new office building and greenhouses for the horticultural department have recently been constructed.

MASSACHUSETTS HATCH STATION.—A small dairy building, to cost about $2,000, is being constructed for the station at State expense. It will be used for experimental purposes, and especially for studying the effect of different feed stuffs upon the quality (flavor, hardness, etc.) of butter. It is hoped later to take up investigations in dairy bacteriology. The building is of wood, all the outside walls having dead-air spaces, and is 44 ft. long and 21 ft. wide, with an office jutting out from the building 8 by 10 ft. The main building contains an ice house 14 by 20 ft., located at the north end. The general dairy room, situated in the center of the building, is 16 by 20 ft.; the pasteurizing and cream-ripening rooms at the south end are each 10 by 12 ft. The general dairy room will contain the milk-receiving vat, separator, churn, and butter worker. The pasteurizer and receiving vat are 3½ ft. above the separator, so that the milk will be carried to the latter by gravity. The floor of the building will be of artificial stone and the walls of adamant plaster, covered with several coatings of enamel paint. Steam will be supplied from a boiler located in the basement of the experiment barn 100 ft. distant. The power for running the separator, churn, and butter worker will be supplied by a water motor, thus doing away with an engine and keeping coal dust, etc., entirely out of the creamery.

NEW HAMPSHIRE COLLEGE AND STATION.—The department of agriculture and horticulture has been divided into two departments. The department of horticulture will include the garden, greenhouses, and grounds around the experiment-station building, and will be in charge of F. M. Rane, horticulturist. The department of agriculture will include the farm, barns, and live stock, and will be in charge of Charles W. Burkett, associate professor of agriculture and agriculturist.

NORTH CAROLINA STATION.—This station, upon the recommendation of the director and horticulturist, and by order of the board of trustees, has withdrawn from the management of the experimental farm of the North Carolina State Horticultural Society, located at Southern Pines, North Carolina.

OKLAHOMA STATION.—The board of regents has been reorganized as follows: President, B. S. Barnes, Ponca City; treasurer, C. J. Benson, Shawnee; C. M. Barnes, (*ex-officio*) Guthrie; R. J. Edwards, Oklahoma City; J. C. Tousley, El Reno; and F. J. Wikoff, Stillwater.

VIRGINIA STATION.—Charles McCulloch, a graduate of the American Veterinary College and of the Columbian University, has been appointed assistant veterinarian, *vice* F. S. Roop, resigned.

WASHINGTON STATION.—S. B. Nelson, veterinarian of the station, has been made secretary to the State Board of Health.

WYOMING STATION.—This station has made a change in the system of its publications. Hereafter the bulletins will be popular accounts of the work of the station and adapted to local needs, while all matters of a technical nature will be published in the annual report. Bulletins will not be sent outside of the State except on request, but the annual reports, including the bulletins, will be sent to the official list.

AGRICULTURE OF THE PHILIPPINES.—Lieut. A. P. Hayne, formerly of the California University and Station and at present stationed in Manila, has been detailed at

the request of the Secretary of Agriculture to investigate the agriculture of the Philippine Islands. He will be in charge of an expedition to make an agricultural survey of the islands, and will be assisted in this work by a detail of about 50 men now serving in the Volunteer Army, most of them college graduates and several graduates of our agricultural colleges.

NECROLOGY.—Dr. Ferdinand Cohn died suddenly at Breslau June 25 of heart disease. He was born in 1824 and has occupied the chair of botany at Breslau since 1859. During recent years he has been engaged principally in the field of bacteriology and has written a book on the Development of Microscopic Algæ and Fungi, showing the destructive action of parasitic forms. Dr. Brefeld, of Münster, has been elected his successor.

Professor Gibelli, professor of botany and director of the botanic garden at Turin, died September 16, 1898.

Dr. Anton Ritter Kerner von Marilaun, director and professor of botany of the botanical gardens at Vienna, died June 21, 1898.

Prof. Ernst Stöckhardt, formerly director of the Agricultural Institute at Jena, died at Bautzen on March 27, 1898.

MISCELLANEOUS.—Notice is given by the Royal Academy of Economy and Agriculture of Florence that a meeting will be held at that place during 1899 to consider the subject of the advanced or delayed maturity in certain plants under varying conditions, the principal subjects of consideration being the difference in the growth of woody and herbaceous plants when removed to latitudes or altitudes different from those of their original habitat. The society has concluded to offer a prize of 1,200 francs and a diploma and silver medal for the best monograph on the subject proposed. The papers must be written in Italian or French and submitted to the academy by June 30, 1900. The secretary of the academy is A. Franchetti.

A division of agriculture and forestry has been established in connection with the German Imperial Health Office at Berlin. The new division will be in charge of Prof. Georg Rörig, of Konigsberg. Prof. Moritz, formerly of the chemical division of the Health Office, has accepted a position. Prof. J. Behrens, of Karlsruhe, has been appointed agricultural bacteriologist, and Dr. C. Freiherr von Tubeuf, formerly director of the Bavarian station of plant protection and plant diseases, will become the botanist.

A department of agronomy is to be added to the Bohemian technical high school at Prague, and Dr. J. Stoklasa has been selected as professor of plant production.

The University of Aberdeen, Scotland, has received a bequest of $60,000 for the establishment of a garden under the name of the Cruickshank Botanical Garden, and Prof. James W. Traid has been appointed to the directorship of the same.

Dr. Charles R. Barnes, of the University of Wisconsin, has gone to Chicago University as professor of plant physiology. He has been succeeded in the University of Wisconsin by Dr. R. A. Harper, late of Lake Forest University.

Dr. Arthur Bornträger has been chosen as director of the agricultural station at Palermo, Sicily.

Dr. Buchner, of Tübingen, has become professor in the agricultural high school of Berlin.

Dr. F. W. Dafert has been appointed director of the Imperial Agricultural Chemical Experiment Station in Vienna.

Dr. A. G. Grevillius has removed from Münster to the agricultural experiment station at Kempen on the Rhine.

Dr. Daniel Morris has been appointed commissioner of the Imperial Department of Agriculture for the West Indies. Dr. Morris was formerly assistant director of the Royal Gardens at Kew.

Dr. A. Richter has been chosen chief of the botanical division of the Hungarian National Museum.

Dr. Hugo Zukal has been made extraordinary professor of phytopathology in the High School for Soil Culture in Vienna.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director*.

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
——— ———Entomology and Veterinary Science.
R. A. EMERSON—Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. No. 5.

The New York State Experiment Station at Geneva has recently completed and dedicated a biological and dairy building (fig. 10) which contains many features of interest and some which are unique.

An appropriation of $41,000 was made by the State assembly in 1896 for the construction and equipment of a building to be devoted to the biological sciences and to dairying. Steps were immediately taken to secure plans and let contracts, but it was not until September, 1897,

FIG. 10.—Biological and Dairy Building, New York State Experiment Station.

that ground was broken for the foundation, and about a year was required for completing the building.

The new laboratory consists of a main building, 88 by 38 feet, and 2 wings, 33 ft. wide and extending 30 ft. to the rear, giving an open court 16 ft. in width between the wings. It is 2 stories in height, with a basement extending under the entire building. The building material of both the main building and wings is the best quality of cream-

colored pressed brick, with Medina stone trimming. The basement is 11 ft. clear, the concrete floor being at grade in the rear, with doors into each wing and into the main building from the court. There are 2 elevators for the delivery of supplies and the handling of the dairy products, one in front to the first story, and one in the rear to both first and second stories. The roof is of slate, with galvanized iron cornices, and is so shaped that the attic rooms are large and high. Abundance of light is given these rooms through 6 double dormer windows at the sides, a round window in front, and a skylight above.

The interior of the building is finished in quartered oak; hard plaster is used throughout; and the floors are of Southern pine except in the vaults and 4 dairy rooms, where vitrified tile is used.

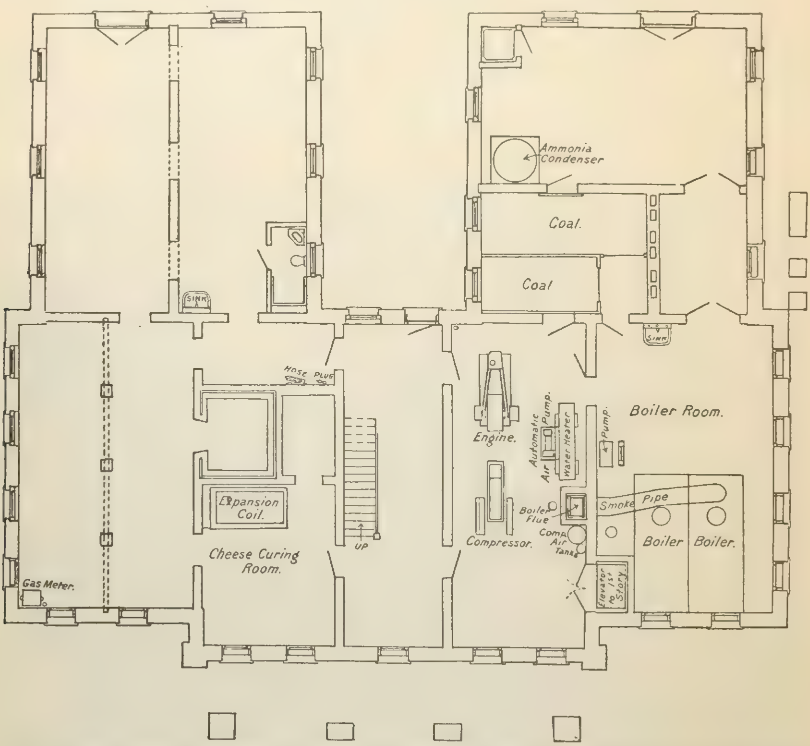

FIG. 11.—Basement plan of Biological and Dairy Building, New York State Experiment Station.

The building is heated by steam from two 30-horsepower boilers, the radiators in each room being controlled by automatic valves connected with thermostats and operated by compressed air by the Johnson system. Steam from the boilers, compressed air and hot water from the compressor and heater (both also in the basement), and cold water and gas from the city system are supplied at the laboratory tables and other convenient points. Constant pressure upon the water system is maintained by connection with a 1,000-gallon tank in the attic.

For securing constant temperatures in the cheese-curing rooms and bacteriological culture rooms, and low temperature in the dairy and cold-storage rooms, a supply of cold air is necessary. This is furnished by an extensive refrigerating plant, operating on the ammonia-expansion principle, located in the basement. Expansion coils connected with the apparatus are provided in a cheese room in the basement, the butter room, pasteurizing room, cold-storage room, and large insulated rooms in the attic. Part of these coils are immersed in brine tanks, so that a low temperature, secured during the day, can be maintained at

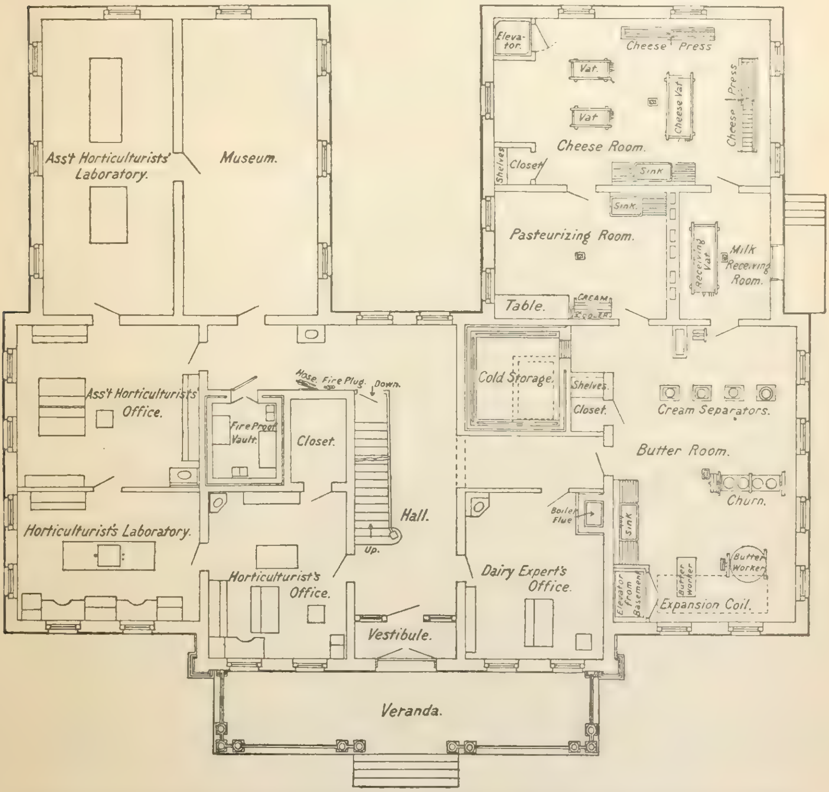

FIG. 12.—First floor plan of Biological and Dairy Building, New York State Experiment Station.

night without running the machinery. The power for the compressor and other machinery is furnished by a 25-horsepower horizontal engine.

The building is well supplied with wash basins, sinks, and closets, the most modern and thoroughly sanitary plumbing and drainage being used throughout.

In the basement (fig. 11) are the machinery and boiler rooms, several large coal and storage rooms, and one large room for curing Brie, cream, and similar cheeses which require moisture and darkness. This room is provided with cooling apparatus.

On the first floor (fig. 12) the 5 rooms occupying the left side of the main building and the east wing are devoted to horticulture. These consist of a horticulturist's office, 18 by 15 ft., with a large dark closet attached; horticulturist's laboratory, 20 by 14 ft.; assistant horticulturists' office, 20 by 17½ ft.; assistants' laboratory, 32 by 14½ ft., and a museum, 32 by 14⅝ ft. One of the fireproof vaults for the preservation of records is located in this part of the building, the other vault being upon the second floor, just above it. The museums also are practically fireproof. The offices here, as throughout the building, are thoroughly equipped with oak furniture. The laboratories each have a large work table, with Alberene stone top and sink, fitted with the conveniences previously mentioned. The windows are provided with wide microscope tables or shelves; and these as well as the projecting ledges of the microscope and reagent cases are fitted with removable plate-glass tops to prevent staining.

At the right of the main entrance is the office of the dairy expert, which opens into another hall at right angles to the main one and leads to the butter room. The latter is 32 by 20 ft. in size and, like the milk-receiving room, pasteurizing room and cheese room, is finished entirely in white. The floors of these rooms are of vitrified tile, with sufficient pitch to give ready drainage, and the sides have a wainscoting of enameled brick. The apparatus is also all finished in white enamel. In the south end of the butter room, next to the milk-receiving room, are the four separators—a United States steam turbine, a United States belt power with intermediate connection, a DeLaval steam turbine, and an Empire with direct belt connection. Near the middle of the room is the box churn, which contains four compartments so that four samples of cream may be handled at once under uniform conditions. At the north end of the room are the hand and power butter workers, with expansion coils above to secure proper temperature. This portion of the room can be shut off from the rest by a curtain when necessary. Opening from this room are an elevator to the basement, a large closet, and the cold storage room. The milk-receiving room has an outer door leading to a platform, and contains a large vat and steam pump to receive the milk and distribute it to separators, pasteurizer, or cheese vats.

In the pasteurizing room are the steam pasteurizer, milk cooler, and Babcock tester. The upper coils over which the milk flows in the cooler circulate cold water and the lower ones ammonia, so that economical and rapid cooling is secured. The cheese room communicates by an elevator with the basement and with the second story near the cheese-curing rooms, and contains one large and two small cheese vats, and large and small constant pressure cheese presses.

Upon the second floor (fig. 13) the arrangement of rooms in the left half does not differ from that of the first story. These rooms are the botanist's office, laboratory, and museum, and the entomologist's office and laboratory. The cheese curing rooms occupy the right wing, and are

separated from its outer wall on all sides by a 4-foot passageway. They are further insulated by double walls and air spaces on the outside and between the separate rooms. These rooms are 6 in number, each 9 by 10 ft., with shelves 14 in. wide and 12 in. apart over the entire wall space. It is expected to control the temperature in each of these rooms within 2°, running each room independently and at any temperature between 30 and 90°. A hot-air flue from below, and a cold-air flue from the chamber in the attic containing the expansion coils and brine tanks, lead into each room. These flues are closed by dampers operated by compressed air and controlled by thermostats. When the temperature

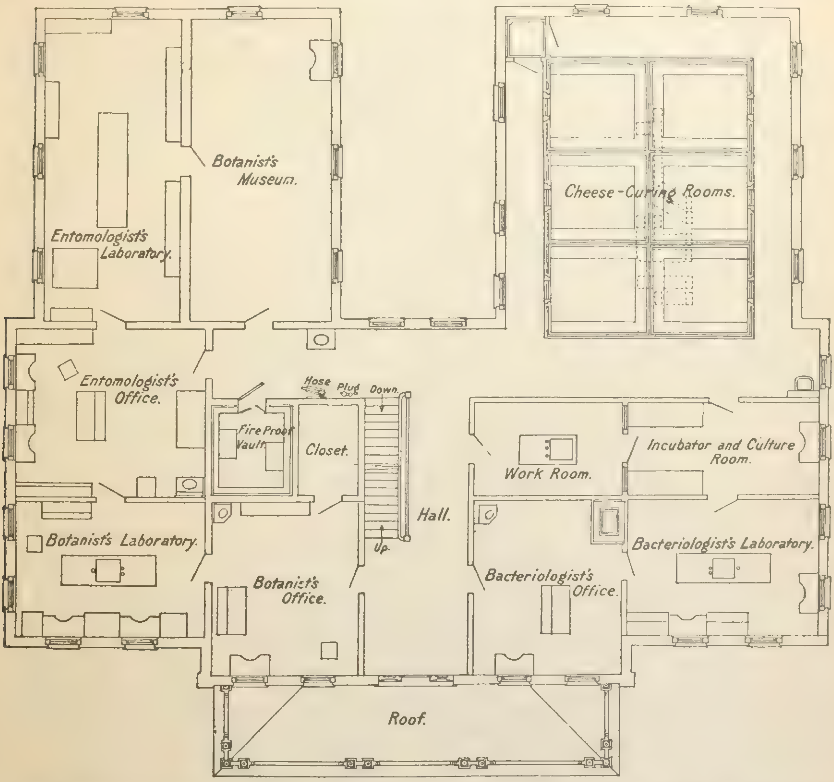

FIG. 13.—Second floor plan of Biological and Dairy Building, New York State Experiment Station.

falls 1° below the point fixed upon, the thermostat turns a valve and the compressed air opens the hot-air damper near the floor. Should the temperature rise, the cold-air flue in the ceiling is opened. So delicate is the operation of this system that breathing upon the thermostat will open the cold-air flue, and fanning it will open the hot-air damper.

In front of the second story and to the right of the center are the bacteriologist's office and laboratory, a culture and incubator room, and a storage and work room. A portion of the incubator and culture room can be shut off from the rest by a glass partition and its temperature

held where desired by a cold-air flue and radiator automatically controlled.

In the attic only the east half has been finished off and these rooms are used for photographic work. These consist of a gallery 36 by 34 ft., lighted by an 8 by 10 ft. skylight and a large double dormer window, a dark room, and a finishing room.

In the west half of the attic is the chamber containing the large ammonia expansion coils and brine tanks. This chamber is insulated with great care by air spaces on all sides and by thick double-air-spaced walls, so that very little heat from without can enter.

It will be seen that the facilities offered by this new building are exceptional for the study of dairy problems, and especially those connected with cheese making. The details of the process of curing cheese are very imperfectly understood at the present time, even by scientists, who differ in their theories as to the nature and cause of the changes which take place and the conditions which influence them. The subject is an intensely practical one, and the more so from the fact that in practice the curing process receives relatively little attention from cheese makers. "The watchful eye of the maker is too often diverted from the cheese as soon as it is placed upon the shelves. An inspection of the conditions under which cheese is cured in this country almost without exception shows that the details of the curing process receive little or no attention. Curing rooms are built in the cheapest possible manner. No attempt is made to control the temperature or the moisture content of the same. It is not at all uncommon to find cheese stored in places the temperature of which is subject to almost as much fluctuation as the outside air."[1]

This is possibly too strong a statement as applied to the whole country, but it undoubtedly represents a condition of affairs which prevails in a large majority of cheese-making establishments, resulting in a "monetary loss amounting to many millions of dollars."

The arrangements in the new building for controlling the temperature of the cheese-curing rooms, with additional arrangements to be provided for controlling the humidity, will afford exceptional means for studying this phase of the ripening process. The services of a bacteriologist, who entered upon his duties with the beginning of the new year, will be an additional element of strength.

It is a matter for congratulation that the important investigations in cheese making which the station has made in the past are to be resumed under such favorable conditions.

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[1] Babcock and Russell.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Formation of furfurol from cellulose and its oxy and hydro derivatives, L. VIGNON (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 19, pp. 1355–1358*).—In these investigations cotton fiber was subjected during 1 hour at a boiling temperature to the action of (1) hydrochloric acid, (2) potassium chlorate, and (3) stannous chlorid. In the first and third cases hydrocelluloses were obtained; in the second case an oxycellulose was formed. These three substances, as well as starch and cotton fiber bleached with chlorin and oxycellulose obtained from such fiber by treatment with chromic acid, were subjected to the action of hydrochloric acid (1.06 sp. gr.) at a boiling temperature according to the Tollens method for the determination of furfurol. The furfurol was determined in the distillate from the solutions by means of phenylhydrazin. The results are given as follows:

Furfurol obtained from cellulose, cellulose derivatives, etc.

	Furfurol.		Furfurol.
	Per cent.		*Per cent.*
Hydrocellulose (1)	0.854	Starch	0.800
Oxycellulose (2)	2.113	Bleached cotton	1.800
Reduced cellulose (3)	.860	Cotton fiber treated with chromic acid	3.500

During the formation of the furfurol carbon dioxid was evolved, which was collected and determined. The carbon dioxid evolved bore a fixed relation to the amount of furfurol obtained.

The author also studied the formation of furfurol from the products of decomposition of oxycellulose by potash. Samples of oxycellulose prepared by treating cotton fiber with chlorate of potash and hydrochloric acid (A) and with chromate of potash and sulphuric acid (B) were treated with potassium hydrate (20° Baumé) at ordinary temperature for 5 hours, using 200 cc. of the potash solution to 25 gm. of the oxycellulose. In each case an insoluble residue remained. By saturating the potash solution with hydrochloric acid, a white gelatinous precipitate was obtained which was collected and dried. A certain

amount of material remained dissolved in the potash solution after neutralization. These 3 products were tested for furfurol with the following results:

Furfurol in potash decomposition products of cellulose derivatives.

	Furfurol.	
	A.	B.
	Per cent.	*Per cent.*
Insoluble residue	0.86	0.76
Precipitate from potash solution	4.35	5.11
Substance not precipitated by acid	1.10	1.54

The reduction of nitric oxid by copper, with special reference to Dumas's method of estimating nitrogen, T. GRAY (*Jour. Soc. Chem. Ind., 17* (*1898*), *No. 8, pp. 741–743*).—In order to determine the conditions in the Dumas method of determining nitrogen under which reduction of nitric oxid by metallic copper takes place, the author passed pure nitric oxid and mixtures of the oxid with nitrogen, at different rates, over copper spirals of different lengths heated to redness in combustion tubes, and analyzed the resulting gas. The results showed that when the copper was sufficiently heated, it was a very efficient reducing agent. Spirals which had been oxidized and reduced several times proved to be more effective than new spirals.

"A 3-in. spiral effected complete reduction of the nitric oxid when the mixed gases were passed over it at such a rate that approximately 30 cc. were collected in about 3 minutes, but part of the nitric oxid escaped reduction when the speed was increased much above this. With a 5-in. spiral complete reduction took place even when the rate of passage was about three times as great. This rate is very much greater than that at which a combustion is conducted, but the conditions are not identical, as the gases in the latter case are diluted to a considerable extent by the carbon dioxid and water vapor produced by the oxidation of the carbon and hydrogen of the substance."

To determine the efficiency of reduction under the conditions of ordinary combustion, examinations were made of the gas obtained by combustion with a 5-in. spiral of acetanilid, uric acid, and hippuric acid. The gas was free from nitric oxid in all but 2 cases, and in these the amounts were very small.

The author concluded that when carbon dioxid is used to expel the air from the combustion tube, "a spiral 5 in. long should be used. This should be tightly rolled and of such a thickness that some pressure is necessary to push it into the combustion tube. The spiral should be strongly heated and the current of carbon dioxid which is used to expel the air from the tube should be stopped while the combustion is taking place."

On the determination of potash without the previous removal of iron, calcium, etc., C. C. MOORE (*Jour. Amer. Chem. Soc., 20* (*1898*), *No. 5, pp. 340–343*).—The acid solution of the substance, without previous removal of calcium, iron, etc., is evaporated on a steam bath

with slight excess of platinum chlorid until the residue solidifies on cooling. From 15 to 25 cc. of acidulated alcohol prepared by passing dry hydrochloric-acid gas into cool 90 per cent alcohol is then added to the solution, which is allowed to stand 2 or 3 minutes, with occasional stirring. The solution is passed through a filter and the residue washed once or twice by decantation, then thrown upon the filter and washed with the acid alcohol until the excess of platinum chlorid is removed. The precipitate is then washed first with ammonium chlorid solution (200 gm. of chlorid per liter of water) and afterwards with 85 per cent alcohol.

The acidulated alcohol used in this method is prepared by gently heating strong aqueous hydrochloric acid in a flask and passing the liberated gas through sulphuric acid and into alcohol kept in a cooled vessel. This is continued until 1 cc. of the alcohol neutralizes about 2½ cc. of normal potassium hydroxid.

The method was tested with very satisfactory results on a sample of ash and on mixtures of known composition containing varying amounts of potassium, calcium, sodium, iron, and aluminum salts. In case ammonium salts are present, it is recommended that they be decomposed and removed by means of nitric acid, as explained in Crooke's Select Methods, p. 32.

Determination of potash in potassic fertilizers, L. Ronnet (*Rev. Chim. Analyt., 1897, No. 21; abs. in Bul. Assoc. Chim. Sucr. et Distill., 16* (*1898*), *No. 1, pp. 76, 77*).—The author recommends the following modification of Schloesing's method: In case of potassium chlorid dissolve 50 gm. of material in water, make up to 1 liter, mix, and filter. To 20 cc. of the filtrate add 10 cc. of saturated solution of barium hydrate; pass carbon dioxid through the solution for a few minutes to precipitate the excess of barium, and boil on a water bath until the carbon dioxid dissolved in the solution and contained in bicarbonates is driven off; filter, add perchloric acid, and continue the operation in the usual way.

Potash is determined in sulphate and kainit in exactly the same manner, except that 40 cc. of the barium solution is used in case of the sulphate and 30 cc. in case of the kainit and the precipitate is washed longer.

In the case of complex fertilizers dissolve 25 gm. in hot water. After cooling, make up the volume to 500 cc., mix, and filter. Evaporate 100 or 200 cc. of this filtrate to dryness in the presence of 1 or 2 gm. of slacked lime. Calcine at a low temperature until the organic matter is destroyed, the ammonia salts volatilized, and superphosphates transformed into insoluble tribasic phosphates. Take up in a small quantity of boiling water, filter, add barium solution as long as any precipitate forms, precipitate excess of barium with a current of carbon dioxid, boil, and filter. Determine potash in the filtrate in the manner described above.

Method of preparing a strictly neutral ammonium citrate solution, A. D. Cook (*Jour. Amer. Chem. Soc., 20 (1898), No. 8, pp. 585, 586*).—The difficulty of preparing a strictly neutral ammonium citrate is briefly discussed and the following method is recommended:

"Seven hundred and forty grams of commercial citric acid is carefully weighed out and placed in a 4-liter graduate containing 1,900 cc. of 10 per cent ammonium hydroxid. With a suitable glass rod the citric acid is thoroughly and vigorously stirred until the citric acid has all dissolved. Distilled water is now added until the meniscus reads 4,000 cc. The solution is again stirred and carefully transferred to a large porcelain evaporating dish. The solution is allowed to stand over night and in the morning large oval crystals are noticeable on the sides of the 4-liter graduate, and invariably the solution when tested for neutrality will be found strictly neutral. If the solution is not vigorously stirred sufficient heat will not be evolved to drive off the excess of ammonia, and when tested will be found to be slightly alkaline, but by resorting to vigorous stirring a strictly neutral reaction will be obtained. The solution, after being transferred to the reagent bottle, is brought to the required temperature, 20° C., and distilled water added until the specific gravity is 1.09. On testing the neutrality of this solution, both with coralline and cochineal as indicators, it will be found unnecessary to alter its neutrality in the least degree, the solution being strictly neutral."[1]

A method for determining perchlorate in sodium and potassium nitrates, N. Blattner and J. Brasseur (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 12, p. 539; and Chem. Ztg., 22 (1898), No. 59, pp. 589, 590*).—The method recommended is as follows: Determine chlorin by the usual method in the original substance, then dry and pulverize 5 or 10 gm. of the nitrate. Mix with 8 to 15 gm. of pure lime obtained by calcining pure precipitated calcium carbonate. Place the mixture in a covered platinum or porcelain crucible and heat in the flame of a Bunsen burner for 15 minutes. After cooling remove the contents of the crucible to a flat-bottomed flask, dissolve in dilute nitric acid (free from chlorids), and determine chlorin in the solution by means of silver nitrate either in acid solution, according to Volhard, or in a solution neutralized by calcium carbonate, or by weighing the silver chlorid. By this means chlorin in chlorids, chlorates (if any are present), and perchlorates are determined. From these data the amount of perchlorates present may be calculated.

The determination of phosphoric acid in superphosphates, L. Vignon (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 21, pp. 1522, 1523; 127 (1898); No. 3, p. 191*).—The determination of water-soluble and citrate-soluble phosphoric acid in 1 sample of bone superphosphate and 2 samples of mineral superphosphate are reported. The percentages of soluble phosphoric acid found were 14.32, 14.13, and 10.20 per cent, respectively. The percentages of citrate-soluble phosphoric acid were 0.77, 0.27, and 3.1, respectively, when the solution was allowed to stand 8 hours before filtration and 1.08, 0.45, and 3.18, respectively, when allowed to stand 15 hours before filtration. When phosphoric

[1] Compare De Roode's method, Jour. Amer. Chem. Soc., 17 (1895), p. 47 (E. S. R., 6, p. 864).

acid was determined in the combined water solution and citrate extract, the following percentages were found, viz, 17.79, 14.94, and 13.91. Subtracting the percentages of water-soluble phosphoric acid from these figures, we have for citrate-soluble phosphoric acid, by difference, 3.47, 0.81, and 3.71 per cent, figures which are much higher than those obtained by determining the citrate-soluble phosphoric acid separately. The author recommends the method of determining phosphoric acid in the combined solutions as more rapid and accurate than separate determinations, especially when, as is usual in superphosphates, the amount of citrate-soluble phosphoric acid is small.

A new method for determining crude fiber in foods and feeding stuffs, J. König (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 1, p. 3; abs. in Centbl. Agr. Chem., 27 (1898), No. 10, pp. 706–711*).—The author calls attention to the fact that the treatment with 1.25 per cent sulphuric acid and potash solution by the Weende method for crude fiber only dissolves a part of the pentosans, and describes a method which he has worked out for the determination of crude fiber freed so far as possible from pentosans. The method is as follows: Three grams of air-dry substance is mixed in a porcelain dish of 500 cc. capacity with 200 cc. of glycerin containing 20 gm. of concentrated sulphuric acid to the liter. The glycerin used is of 1.23 sp. gr., i. e., contains 87.5 per cent of glycerin. The dish is placed in an autoclave and heated under three atmospheres pressure, i. e., 137° C., for 1 hour. After cooling to 80 to 100° the dish is removed, the contents diluted with 200 to 250 cc. of boiling water, and filtered hot on a porcelain filter plate covered with finely divided asbestus, or on a Gooch crucible. The residue is washed with boiling water, alcohol, and a mixture of alcohol and ether until the filtrate is colorless, after which it is dried to constant weight, incinerated, and weighed, the loss in weight on ignition being taken as ash-free crude fiber. With an autoclave 25 cm. deep and 25 cm. in diameter 4 determinations can be made simultaneously. In the absence of an autoclave the digestion may be carried on in a 600 cc. flask with a reflux condenser, heating at boiling for 1 hour. At a temperature of 120 to 130° frothing usually occurs, but as soon as the liquid comes to boiling there is no further danger of this. The method gives a crude fiber containing from 0 to 6.62 per cent of pentosans. It was found more difficult to remove the pentosans from leguminous coarse fodders than from grasses.

Decomposition of monobarium and monocalcium phosphates by water at 100° C., G. Viard (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 3, pp. 178–180*).—Joly and Sorel[1] have shown that monobasic phosphates of the alkaline earths partially decompose in cold water with the formation of dibasic phosphate, which is precipitated, and free phosphoric acid, which remains in solution with the undecomposed monobasic phosphate. The author's experiments show that the same

[1] Compt. Rend. Acad. Sci. Paris, 118 (1894), pp. 738–741.

decomposition occurs in water at 100° C., the limit being reached when the ratio of total phosphoric acid to combined phosphoric acid was 2.8 in case of monobarium phosphate and 2.31 in case of monocalcium phosphate. The precipitate formed was in every case anhydrous dibasic phosphate insoluble in acetic acid.

A new gas, C. F. BRUSH (*Science, n. ser., 8 (1898), No. 198, pp. 485–494, fig. 1; Jour. Amer. Chem. Soc., 20 (1898), No. 12, pp. 899–912, fig. 1*).—A paper read before the American Association for the Advancement of Science, August 23, 1898, announcing the discovery of a new constituent of the atmosphere to which the name "etherion" is given. "Its chief characteristic thus far ascertained is enormous heat conductivity at low pressures."

Classification of proteids, R. H. CHITTENDEN (*Centbl. Physiol., 11 (1898), p. 497; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12 (1897), No. 4, p. 495*).—The author calls attention to the fact that in 1894 he published a classification similar to Wroblewski's (E. S. R., 9, p. 480).

Nitration of cellulose and of its hydro and oxy derivatives, L. VIGNON (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 23, pp. 1658–1661*).—This is a continuation of previous work (see p. 407), in the course of which it was shown that cellulose and hydrocellulose yielded small quantities of furfurol and the nitro-oxycellulose large quantities.

On the determination of phosphoric acid, H. LASNE (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 1, pp. 62–64*).—The author reports determinations of water-soluble and citrate-soluble phosphoric acid in mineral, raw bone, and degelatinized bone superphosphate which show that small amounts of citrate-soluble phosphoric acid may be accurately determined by precipitation in the extract if the solution is allowed to stand 16 hours before filtration.

Formation of furfurol from starch and its derivatives, F. SESTINI (*L'Orosi, 21, pp. 109–113; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 9, p. 861*).—Starch heated dry at about 200° C. and in the presence of acids at 100° C. is said to yield furfurol.

On the Lindo-Gladding method of determining potash, A. L. WINTON and H. J. WHEELER (*Jour. Amer. Chem. Soc., 20 (1898), No. 8, pp. 597–609*).—This is a paper prepared by a committee appointed by the Association of Official Agricultural Chemists of the United States with a view to meeting certain criticisms of the Lindo-Gladding method of determining potash, notably those of Vogel and Haefcke (E. S. R., 8, p. 457).

Determination of sulphuric acid in wine and vinegar, F. BIMBI (*Bol. Chim. Farm., 37, p. 133; abs. in Bul. Soc. Chim. Paris, 3. ser., 20 (1898), No. 13, p. 575*).

On the bodies reducing Fehling's solution in fruit juices, ADERHOLD and HEINTZE (*Chem. Ztg., 22 (1898), No. 63, p. 632*).

The deterioration of raw cane sugar in transit or storage, E. C. SHOREY (*Jour. Soc. Chem. Ind., 17 (1898), No. 6, pp. 555–558, figs. 3*).

On the carbohydrates of barley and malt, with special reference to the pentosans. The behavior of the pentosans during the preparation of malt, and during washing and fermentation, B. TOLLENS (*Jour. Fed. Inst. Brewing, 4 (1898), No. 6, pp. 438–454*).

The action of dilute solutions of ortho-phosphoric acid on the albumen of hens' eggs, W. WORMS (*Jour. Soc. Phys. Chim. R., 29 (1897), No. 9, p. 680; abs. in Bul. Soc. Chim. Paris, 3. ser., 20 (1898), No. 12, p. 528*).

Edible fats and oils; analyzing and discriminating (*Jour. Suisse Chim. et Pharm., 35, p. 448; Bul. Assoc. Belge Chim., 11, pp. 160–163; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 1, pp. 76, 77*).

Contribution to the technical analysis of fats, A. SCHUKOW and P. SCHESTAKOW (*Zap. Imp. Rus. Techn. Obschtsch., 32 (1898), No. 3, p. 100; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 8, p. 805*).

The essential oil of hops, A. C. CHAPMAN (*Jour. Fed. Inst. Brewing, 4 (1898), pp. 224–233; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 5, p. 486*).

Method for detecting cotton-seed, sesame, and peanut oils in olive oil, M. TORELLI and R. RUGGERI (*Chem. Ztg., 22 (1898), No. 60, pp. 600–603*).

Remarks on wine and vinegar analysis, L. ERCKMANN (*Chem. Ztg., 22 (1898), No. 66, p. 673*).

Sewage analysis and standards of purity for effluents, C. G. MOOR (*Analyst, 23 (1898), Aug., pp. 198–209*).

The Lamansky-Nobel viscosimeter, L. SINGER (*Chem. Rev. Fett u. Harz-Ind., 4, No. 18, pp. 243–246; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 2, pp. 182, 183*).

Determination of water in milk, butter, etc., A. WROBLEWSKI (*Oesterr. Chem. Ztg., 1 (1898), No. 11, pp. 331, 332, fig. 1*).—The method proposed is similar to the Adams method. Strips of paper are rolled and packed into a weighing glass. After drying to constant weight, the rolls are saturated with 10 to 20 cc. of milk, weighed and dried to constant weight; or in the case of butter, 5 to 10 gm. are placed in small pieces on the rolls, melted by gentle heat and then dried to constant weight.

Milk analyses II, M. WEIBULL (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 3, pp. 148–156*).—Comparisons of the kaolin, paper coil and Gottlieb methods of milk analysis for whole milk, skim milk, and buttermilk.

The introduction of a uniform method for determining fat in milk, M. WEIBULL (*Milch Ztg., 27 (1898), No. 26, pp. 406, 407*).—An address delivered by the author at the second Norwegian agricultural congress. After discussing the various volumetric and gravimetric methods, he concludes that the choice of a "normal" method for milk control lies between the Adams gravimetric method and Gottlieb's modification of Röse's (volumetric) method, "as both of these gave uniform results when used by different persons."

Machine for rapidly calculating the total solids in milk from the specific gravity and fat content (*Milch Ztg., 27 (1898), No. 29, pp. 456, 457, fig. 1*).—A description of a milk scale in the form of a disk, devised by E. Ackermann.

The calculation of "added water" in adulterated milks, H. D. RICHMOND (*Analyst, 23 (1898), July, pp. 169–174*).

On the determination of malic acid in raisins, A. GIRARD and L. LINDET (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 13, p. 585*).

Standard methods for the sampling and analysis of tanning materials, H. R. PROCTER and J. G. PARKER (*Jour. Soc. Chem. Ind., 17 (1898), No. 1, pp. 6–10*).

The effect of different temperatures in the extraction of tanning materials, J. G. PARKER (*Contrib. London Leather Industries Research Lab.; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 2, pp. 106–110*).

The nicotin content of cigars and smoking tobacco sold at retail, H. SINNHOLD (*Arch. Pharm., 236 (1898), No. 7, pp. 522–529*).

The development of official methods of agricultural analysis, J. HENDRICK (*Jour. Soc. Chem. Ind., 17 (1898), No. 4, pp. 326–330*).—Attention is called to the lack of uniformity in official analytical work in England, and the systems evolved in the United States and Germany are explained.

Uniform methods for the analyses of foods, condiments, and commercial products in the German Empire, J. SPRINGER (*Vereinbarungen zur einheitlichen Untersuchung von Nahrungs- und Genussmitteln sowie Gebrauchsgagenständen für das Deutsche Reich. Berlin: 1897, pt. 1; abs. Ztschr. Fleisch u. Milchhyg., 9 (1898), No. 1, p. 18*).—Among the subjects treated are general methods of analyses, preservatives, meat, sausage, meat extract, peptones, milk, eggs, cheese, and fats and oils.

Second meeting of the international commission for uniform methods of sugar analysis (*Chem. Ztg., 22 (1898), No. 64, p. 652*).—An account of the meeting held at Vienna, July 31, 1898.

The analysis of food and drugs: I. Milk and milk products, T. H. PEARMAIN and C. G. MOOR (*London: Baillière, Tindall & Cox, 1897; rev. in Analyst, 23 (1898), Aug., p. 224*).

Report of the chemical station and seed-control station at Skara (Sweden) for 1897 (*Skara: Sven Hammar, 1898*).

Report of the Swedish chemical stations for 1896 (*Meddel. K. Landtbr. Styr., 7 (1897), No. 42, pp. 280–313*).—Eight State chemical stations were in operation during 1896, and 6 additional stations were supported by as many county agricultural societies. At the State stations 43,551 samples were analyzed in all during the year, of which 36,509 were dairy products, principally milk; 1,201 were fertilizers; 568 soil samples; 3,585 were examined for poisons, etc. The county stations analyzed in all 24,524 samples, 90 per cent of which were dairy products.

A monthly summary is given of milk analyses made at Vesteras Chemical Station during 1896, including 17,166 analyses. The average for the year was 3.35 per cent of fat.—F. W. WOLL.

BOTANY.

On the nitrogen assimilation of plants, L. LUTZ (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 17, pp. 1227–1229*).—The author briefly reviews the work of a number of investigators in this line and states that Ville has shown that plants are able to assimilate methylamin and ethylamin, but his conclusions were subject to error on account of the fact that no attempt was made to exclude micro-organisms. Frank is stated to have shown that leucin, tyrosin, and alkaloids are not assimilable. Bokorny has stated that Spirogyra is able to grow in a nutrient solution containing trimethylamin sulphate. On the other hand, Réveil has claimed that alkaloids are poisonous to plants, while Cornevin and Heckel have shown that under certain conditions they may be utilized.

The author describes in considerable detail his experiments and in conclusion states that phanerogams are able to assimilate their necessary nitrogen from amins in the form of salts without those substances being transformed into ammonium salts or nitrates. For this assimilation it is necessary that the amins should be presented in a comparatively simple form. Methylamin has proved an excellent source of nitrogen, while benzylamin, pyridin, glycolamin, and betaïn are unassimilable. Phenolamin is said to be very poisonous and the compound ammonium salts and alkaloids are not directly assimilable. In most cases where the nutrient solution contained nitrogen in an unassimilable form the plants lost a considerable amount of their initial nitrogen. In this connection the author states that their period of growth was prolonged considerably beyond what it would have been under ordinary conditions without the intervention of micro-organisms, and the question is raised whether or not there was not some form of self-fermentation present. The author sought to ascertain the form in which the nitrogen disappeared from these plants, and claims that his investigations showed that it was liberated in a gaseous state.

Influence of diffused light on the development of plants, J. WIESNER (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 18, pp. 1287–1289*).—The author reports a series of experiments with *Impatiens balsamina*, *Reseda odorata*, *Tropæolum majus*, and *Ipomœa purpurea*, which

were planted after germination on slopes with north, east, south, and west exposures. The plants on the north exposure received an average of $\frac{1}{4.2}$ of the total illumination of the sun. All of the 4 species planted bloomed on the north exposure. The Impatiens, Tropæolum, and Ipomœa had well-developed and abundant flowers. The Reseda flowers were few and the inflorescences small. All of the plants fruited and produced viable seeds. The plants given a southern exposure flowered much earlier, the Reseda exceeding the plants grown with north exposure by 6, the Impatiens by 13, the Tropæolum by 16, and Ipomœa by 17 days.

The author's experiments seem to show that the 3 rather dissimilar families of plants represented are able to completely develop in diffused light.

Analogous experiments with *Sedum acre*, a species of plant which usually grows in sunny exposures, showed that the vegetative growth of the plant developed in the northern exposure, but the plant did not flower. It is evident that $\frac{1}{4.2}$ of the intensity of light is not sufficient for the development of this plant.

On the direct fertilization of plants whose flowers seem adapted to cross fertilization, C. GERBER (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 24, pp. 1734–1737*).—The author claims that by the peculiar form of the calyx of *Cistus albidus* the plant is close pollinated instead of cross pollinated, as would seem to be indicated from the structure of the flower. The same has been observed in other species of this genus, namely, *C. salvifolius*, *C. hirsutus*, and *C. villosus.*

Penicillium as a wood-destroying fungus, H. MARSHALL WARD (*Gard. Chron., 3. ser., 24 (1898), No. 612, pp. 224, 225*).—A brief abstract is given of a paper read by the author before the botanical section of the British Association. It is stated that—

"Spores from pure cultures of Penicillium sown on sterilized blocks of spruce wood, cut in March, were found to grow freely and develop large crops of spores on normal conidiophores. Sections of the infected wood showed that the hyphæ of the mold entered the starch-bearing cells of the medullary rays of the sapwood and consumed the whole of the starch. The resin was untouched. In cultures three months old the hyphæ were to be seen deep in the substance of the wood passing from tracheid to tracheid *via* the bordered pits. Control sections, not infected and kept side by side with the above, contained abundance of starch and no trace of hyphæ could be detected in them. The observation appeared of interest in several connections. Penicillium was one of our commonest molds and undoubtedly played a part in the reduction of plant débris to soil constituents; how far it could itself initiate the destruction of true wood, or how far it merely followed on the ravages of other fungi, bacteria, etc., was unknown. There were strong grounds for believing that it destroyed the oak of casks, etc., but since these were impregnated with food materials, that was not very surprising. It appeared as if Penicillium might be a much more active organism in initiating and carrying on the destruction of wood than had hitherto been supposed, and that it was not merely a hanger-on or follower of more powerful wood-destroying fungi."

Two useful grasses (*Producers' Gaz. and Settlers' Rec.* [*West. Australia*], *5 (1898), No. 4, pp. 289–291, pls. 2*).—Two species of Paspalum

(*Paspalum distichum* and *P. dilitatum*) are figured and described. On account of its decumbent habit, the former is said to be specially adapted for covering river banks or water holes and especially as it withstands temporary inundation and keeps green throughout the year. The second species, which has been introduced into Australia from America, has proved an excellent fodder plant, keeping green during the hottest summer and proving hardy at an elevation of 2,000 ft. It is said to be particularly adapted for cultivation in the light sandy soils on account of its root system, which not only secures moisture from the deeper layers of the soil, but also prevents its destruction by grazing animals.

West Australian grasses, F. TURNER (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 3, pp. 402–417, figs. 10*).—Of the 119 species of grasses found in western Australia the author states that the most valuable and nutritious species are the following: Six species of Andropogon, 3 of Anthistiria, 3 of Chloris, 5 of Danthonia, 2 of Diplachne, 8 of Eragrostis, 8 of Panicum, and 6 of Poa, with several species belonging to other genera. Illustrated descriptive notes are given of 9 of the most valuable grasses, viz, *Andropogon bombycinus*, *Anthistiria arenacea*, *A. ciliata*, *A. membranacea*, *Astrebla pectinata*, *Danthonia semiannularis*, *Panicum decompositum*, *P. gracile*, and *Pollinia fulva*.

Plant life, C. R. BARNES (*New York: Henry Holt & Co., 1898, pp. VII+428, figs. 415*).—This attractive little work treats of plant life considered with special reference to form and function. It is designed to show the variety and progressive complexity of the vegetative body, explain the unity of plan in structure and action of the reproductive organs, and to give an outline of the more striking ways in which plants adapt themselves to their environment. The book is intended to be supplementary to laboratory guides and teachers' directions. The work is divided into the following divisions: The plant body, physiology, reproduction, and ecology; with appendices dealing with laboratory studies, directions for collecting and preserving materials, and descriptions of necessary apparatus and reagents.

While the author states that the work is intended for use in secondary schools, it is confidently believed that its introduction into many institutions not desiring to be so classified would be advantageous both to teacher and student.

A revision of the Mexican and Central American species of Galium and Relbunium, J. M. GREENMAN (*Proc. Amer. Acad. Arts and Sci., 33 (1898), No. 25, pp. 455–470*).

Icones fungorum arranged according to Saccardo's Sylloge, A. N. BERLESE (*Phycomycetes, Pt. I. Berlin: Friedlander & Sohn, 1898, pp. 1–40, col. pls. 67*).—This part treats of the *Peronosporaceæ*.

Hicoria ovata (*Amer. Florist, 14 (1898), No. 542, fig. 1*).—Brief illustrated notes are given concerning this tree.

Notes on some Japanese Melampsoræ, N. HIRATSUKA (*Bot. Mag. [Tokyo], 12 (1898), No. 134, pp. 30–34*).

On the biology and morphology of pollens, A. HANSGIRG (*Sitzber. Böhm. Gesell. Wiss. Math.- Naturw. Cl., 1897, No. 23, pp. 76; abs. in Bot. Centbl., 75 (1898), No. 1, pp. 19–21*).

Symbiosis and parasitism, A. LORENZEN (*Natur, 47 (1898), No. 23, pp. 265, 266*).

Can isolated chloroplastids continue to assimilate? A. J. EWART (*Bot. Centbl., 75 (1898), No. 2, pp. 33–36*).—The author states that it may be accepted as definitely established that isolated chloroplastids may continue to assimilate for a short time after removal from their parent cell.

Concerning sugar and starch formation in barley and malt, J. GRÜSS (*Wchnschr. Brau., 15 (1898), No. 20, pp. 269–275, pl. 1*).

A microscopical study of barley during germination, J. GRÜSS (*Gaz. Brasseur, 1898, No. 550*).

Concerning the michrochemical detection of cane sugar in plant tissues, C. HOFFMEISTER (*Jahrb. Wiss. Bot., 31 (1898), No. 4, pp. 688–699*).

On the formation of diastase by fungi, J. KATZ (*Jahrb. Wiss. Bot., 31 (1898), No. 4, pp. 599–618*).

Concerning plasmolysis and plasmotic membranes, R. CHODAT and A. M. BOUDIER (*Jour. Bot. [France], 12 (1898), No. 8, pp. 118–132, pl. 1*).

Concerning the anatomy and physiology of the assimilatory tissues of plants, L. MONTEMARTINI (*Atti Inst. Bot. Univ. Pavia, 4 (1898), pp. 89-128, pl. 1*).

The general anatomy and physiology of tissues, R. HERTWIG (*Allgemeine Anatomie und Physiologie der Gewebe. Jena: Gustav Fischer, 1898, pp. VIII+314, figs. 89*).—This is the second volume of the series on the general anatomy and physiology of the cell and tissues.

Microchemical investigations of the cell walls of some fungi (*Jahrb. Wiss. Bot., 31 (1898), No. 4, pp. 619–687, pls. 2*).

A key to the principal plant substances, R. H. TRUE (*Pharm. Rev., 16 (1898), No. 1; abs. in Bot. Centbl., 74 (1898), No. 8, p. 237*).—The author gives a key to the principal plant substances based on microchemical investigations.

On the annual growth rings of trees, A. WIELER (*Tharand. Forst. Jahrb., 48 (1898), p. 101*).

Contractile roots and their activity, A. RIMBACH (*Beitr. Wiss. Bot., 2 (1897), pt. 1, pp. 1–28, pls. 2; abs. in Bot. Centbl., 74 (1898), No. 7, pp. 209–211*).—The author reports 70 species representing 6 families of monocotyledonous and 14 of dicotyledonous plants as having contractile roots.

Concerning nuclear structure, F. CAVARA (*Atti Inst. Bot. Univ. Pavia, 2. ser., 5 (1898), pp. 49, pl. 2; abs. in Bot. Centbl., 74 (1898), No. 8, pp. 239–241*).

Moisture, the plant's greatest requirement, J. C. ARTHUR (*Amer. Florist, 13 (1898), No. 508, pp. 813, 814*).—A paper read before the American Carnation Society.

On the substitution of rubidium salts for potassium in some of the lower fungi, O. LOEW (*Bot. Centbl., 74 (1898), No. 7, pp. 202–205*).—The author agrees with Günther that some of the lower fungi are able to utilize rubidium salts in place of potash in their nutrition.

On the influence of sulphur anhydrid on plants in the greenhouse, E. LAURENT and H. GILLOT (*Bul. Agr., 14 (1898), pt. 2*).

Concerning the growth of buds during winter, E. KÜSTER (*Beitr. Wiss. Bot., 2 (1898), No. 2, pp. 401–413, figs. 2*).

On the development of structure of the flower buds of fruit trees and shrubs, J. BEHRENS (*Gartenflora, 47 (1898), No. 10, pp. 269–274*).

Mushroom poisoning, G. ARCANGELI (*Atti R. Acad. Econ. Agr. Georg. Firenze, 4. ser., 21 (1898), No. 1, pp. 65–87*).

A psychrometer applicable to the study of transpiration, R. G. LEAVITT (*Amer. Jour. Sci., 5 (1898), No. 30, pp. 440, 441*).

An osometer and root pressure apparatus, D. T. MACDOUGAL (*Jour. Appl. Micros., 1 (1898), No. 3, p. 56, fig. 1*).

The fecundation of the Lobeliaceæ, Campanulaceæ, and Compositæ, H. DAUTHENAY (*Rev. Hort., 70 (1898), No. 17, pp. 404–408, figs. 5*).

A study of the roots of Sorghum saccharatum, J. ZAWODNY (*Ztschr. Naturw. [Jena], 70 (1898), pp. 169–183; abs. in Bot. Centbl., 75 (1898), No. 3, pp. 88, 89*).

The cell wall of plants, E. STRASBURGER (*Jahrb. Wiss. Bot., 31 (1898), No. 4, pp. 511–598, pls. 2*).

Investigations on the structure of raphid cells, P. C. A. FUCHS (*Oesterr. Bot. Ztschr., 48 (1898), No. 9, pp. 324–332, pl. 1*).

Concerning the knowledge of the starch grain, J. H. SALTER (*Jahrb. Wiss. Bot., 32 (1898), No. 1, pp. 117–166, pls. 2*).

The anatomical structure of the beet leaf, G. FROU (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 10, pp. 397–400, figs. 3*).

An achromatic light filter for high power microscopic work, G. F. EISEN (*Ztschr. Wiss. Mikros. u. Mikros. Technik, 14 (1898), No. 4, pp. 444–447*).

A new apparatus for the application of the electric current to microscopic objects, A. SCHÄPER (*Ztschr. Wiss. Mikros. u. Mikros. Technik, 14 (1898), No. 4, pp. 436–441, figs. 5*).

The sectioning of seeds, M. B. THOMAS (*Jour. Appl. Micros., 1 (1898), No. 2, pp. 32, 33*).—Describes method for imbedding and sectioning seeds.

Celloidin imbedding, F. C. HARRISON (*Jour. Appl. Micros., 1 (1898), No. 8, pp. 145, 146*).—The author briefly describes a method for imbedding hard tissues, woody stems, seeds, etc.

Comparative phenological notes, H. C. IRISH (*Missouri Hort. Soc. Rpt. 1897, pp. 325–339*).—Tables and charts are given showing the blossoming time of various plants during several successive years.

Experiments in the cross fertilization of salices, E. F. LINTON (*Jour. Bot. [London], 36 (1898), No. 424, pp. 122–124*).

Protective coloration and bud formation on leaves, L. GEISENHEYNER (*Deut. Bot. Monatsschr., 16 (1898), No. 7, pp. 132–134*).

Adherence to type in seed breeding, W. W. TRACY (*Amer. Florist, 13 (1898), No. 522, pp. 1311, 1312*).—The necessity of having an ideal and keeping strictly to it in seed breeding is pointed out.

A contribution to the study of wheat, K. HUPPENTHAL (*Beitrag zur Physiographie des Weizens, pp. 19; abs. in Bot. Centbl., 75 (1898), No. 4–5, p. 153*).—The effect of removing 7 varieties of French wheats from maritime conditions to a continental climate was studied. Descriptions are also given of 19 native and 2 Tyrolian varieties. The investigations were conducted in the laboratory of the University of Krakau.

Dissemination of plants by stock cars, J. M. BATES (*Asa Gray Bul., 6 (1898), No. 2, pp. 35–37*).—Shows the manner in which many weeds have been introduced into new localities.

History, uses, and symbolism of plants in ancient and modern times, C. JORET (*Les plantes dans l'antiquité et au moyen âge: Histoire, usages, et symbolism. pp. XX + 504. Paris: Baillon, 1897; abs. in Bot. Centbl., 74 (1898), No. 8, pp. 241–243*).

The origin of gymnosperms and the seed habit, J. M. COULTER (*Science, n. ser., 8 (1898), No. 195, pp. 377–385; also Bot. Gaz., 26 (1898), No. 3, pp. 153–168*).—Address of the retiring President of the Botanical Society of America, delivered at Boston, August 19, 1898.

A study of the andrœcium of gymnosperms, E. THIBAUT (*Thesis. Lille, 1896, pp. 265; abs. in Bot. Centbl., 75 (1898), No. 4–5, pp. 129–131*).

Conception of species as affected by recent investigations on fungi, W. G. FARLOW (*Science, n. ser., 8 (1898), No. 196, pp. 423–435*).—Vice-Presidential address before the section of botany of the American Association for the Advancement of Science, August, 1898. The author believes that physiological characters will assume great importance in the characterization of species.

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 26 (1898), No. 7, pp. 291–391, charts 12; 8, pp. 343–390, charts 7; 9, pp. 391–437, charts 17*).—Besides the usual meteorological summaries No. 7 contains special contributions on Climatology versus meteorology, by M. Whitney; Erroneous conversion

of metric and English barometer readings, by C. F. Marvin; West Indian service, by E. B. Garriott; The Jamaica weather service, by M. Hall; The character of the evening, by P. Connor; Meteorology at Johns Hopkins University, by O. L. Fassig; Tornado at Hampton Beach, New Hampshire, July 4, 1898, by A. E. Sweetland; and notes by the editor on Prof. Mark W. Harrington; ocean temperatures and meteorology; polar versus equatorial climatology; Rockall as a meteorological station; international meteorological symbols; the first Wellman expedition; rainfall measurements on ships; climates of geological ages; barometric readings converted into standard pressures, and bright meteors.

No. 8 contains special articles on Hann's handbook of climatology, by M. W. Harrington; The effect of approaching storms upon song birds, by C. E. Linney; Progress in the exploration of the air with kites at the Blue Hill Observatory, Massachusetts, by L. Rotch; Prof. Park Morrill, by E. B. Garriott and C. Abbe; Destruction by lightning in the State of New York during the month of August, 1898, by R. G. Allen; and notes by the editor on ball lightning; the measurement of the wind; sensible temperatures or the curve of comfort; sensational meteoric story; increase and decrease of fresh-water lakes; heavy rain during hurricane at Port Royal, South Carolina; waterspouts on the lakes; lunar rainbow; earthquakes in Central and South America; the Australian weather guide; ribbon lightning; the kite and telephone; a memorial to Volta, and studies of the Japan current.

No. 9 contains special articles on The probable state of the sky along the path of total eclipse of the sun, May 28, 1900, by F. H. Bigelow; Electric signal apparatus at Atlantic City, New Jersey, by A. Brand; Meteorological observations at Hacienda Perla, Puerto Rico, by A. C. Hansard; Quantity of rainfall corresponding to given depths, by A. J. Henry; Severe hailstorm in Missouri, by A. E. Hackett; The telegraph service with the West Indies, by J. H. Robinson; Aneroid barometers, by C. F. Marvin; and notes by the editor on the Omaha convention of Weather Bureau officials; the weather and the sugar crop; instruction in research; international meteorological symbols, and the second Wellman polar expedition.

Moisture tables, C. F. MARVIN (*U. S. Dept. Agr., Weather Bureau Doc. 171, pp. 9, fig. 1*).—This article, which is reprinted from the Monthly Weather Review, May, 1898, gives a table showing the weight of a cubic foot of aqueous vapor at different temperatures and percentages of saturation, and explains the use of the sling psychrometer as well as the method of making observations with it.

Department of meteorology and agricultural engineering, 1896–97, C. H. PETTEE (*New Hampshire Sta. Bul. 48, pp. 118, 149*).—A brief statement of the work of the year in this department of the station.

Meteorological observations (*Massachusetts Hatch Sta. Met. Buls. 115, 116, 117, pp. 4 each*).—These bulletins give the usual summaries of meteorological observations, with general remarks on the character of the weather during the months of July, August, and September, 1898.

AIR—WATER—SOILS.

Salt River Valley soils, R. H. FORBES (*Arizona Sta. Bul. 28, pp. 66–99, map 1*).—This bulletin contains general remarks on the physical and agricultural features of the Salt River Valley, the objects of soil analysis, essential plant food, and interpretations of analyses, accompanied by tabulated analyses of 21 samples of soils from different parts of Salt River Valley.

The average composition of the soils examined is shown in the following table:

Average composition of Salt River Valley soils.

[In fine earth, water free.]

	Per cent.
Organic and volatile matter	3.569
Insoluble matter—sand, etc.	64.575
Soluble silica—from clay	13.781
Alumina—from clay	6.433
Iron oxid—from clay	4.922
Calcium oxid	2.372
Potassium oxid	.821
Sodium oxid	.425
Magnesium oxid	1.835
Manganese oxid (Mn_2O_3)	.055
Phosphoric acid	.130
Sulphuric acid	.059
Carbon dioxid[1]	1.025
Chlorin	.110
Total	100.112
Humus	.650
Nitrogen	.045
Alkaline salts:	
Total soluble salts	.167
Sodium carbonate	.044
Sodium sulphate	.030
Sodium chlorid	.041

The results indicate that—

"The soils of Salt River Valley, generally speaking, are amply supplied with the more essential mineral (ash) plant foods, including lime, potash, and phosphoric acid.

"Nitrogen and humus are undoubtedly deficient in quantity, and the addition of these soil ingredients is desirable, perhaps imperative.

"Alkaline salts are not prevalent in excessive amount except in occasional localities of limited area. The alkali is very 'white' in character and, consequently, its injurious effects are minimum.

"Probably the most serious difficulty with our virgin soils is a physical one. Their dense, compact condition must be remedied by suitable methods of culture.

"The cheapest and best methods of supplying the lack of humus and nitrogen, and of improving the tilth and water-holding power of these soils is by growing

[1] This amount of carbon dioxid calculates to 2.33 per cent of carbonate of lime.

leguminous crops upon the lands and plowing them under as green manuring. So far as now known alfalfa and crimson clover are the best of these, and their use for this purpose is undoubtedly an essential part of any scheme of crop rotation for this region."

Materials for the study of Russian soils, XI, A. SOVYETOV and N. ADAMOV (*St. Petersburg, 1898, pp. 221; abs. in Selsk. Khoz. i Lyesor., 189 (1898), June, pp. 711, 712*).—This part contains, among others, the following articles: The influence of the electrization of the soil on the processes which take place in it, by S. Kravkov; the assimilation by plants of the nitrogen of the soil as dependent upon meteorological conditions, by A. Doyarenko; and the absorbing power for phosphoric acid of some Russian soils, by V. Krat.

The first article gives, besides a brief review of literature on the question of electroculture, the results of the author's laboratory investigations relating to the study of the physical and chemical properties of the soil subjected to electrization. The following are the results arrived at: A galvanic current passed through the soil produces a marked influence on many chemical and physical processes taking place in it. First of all its action is shown in an intensified decomposition of the organic matter in the soil, causing the formation of an excess of carbon dioxid, which in its turn acts as a solvent on the constituents of the soil. The increased concentration of the soil solution in its turn (1) decreases the intensity of the evaporation of water by the soil; (2) reduces greatly the capillary power of the soil; (3) lowers to the minimum its percolating capacity; and (4) somewhat alters the character of the structure of the soil, rendering it larger grained. In general, according to the author, the protracted action of the galvanic current may reduce chernozem soils to great poverty in humus and lead to complete exhaustion.

The second article gives the results of experiments by the author with winter wheat, which established the dependence of the assimilation of nitrogen on atmospheric precipitation (in dry weather less nitrogen is assimilated than in rainy weather), as well as a similar connection between this process and the temperature, humidity, and sometimes the barometric pressure.—P. FIREMAN.

Composition of Indian soils, J. W. LEATHER (*Agr. Ledger (Agr. ser., No. 24), 1898, No. 2, pp. 83*).—According to the author four main types of soils occupy by far the greater part of the cultivated area of India. These are "the Indo Gangetic and other alluvium, the black cotton soil or *regur*, the red soils lying on the metamorphic rocks of Madras, and the laterite soils which are met with in many parts of India. There are doubtless other minor classes of soils, but they neither possess such characteristic differences in appearance, nor are they distributed over such extensive areas as the 4 types referred to." Chemical analyses, descriptions, etc., are given of 22 samples of the first class, 18 of the second, 7 of the third, and 12 of the fourth, besides of 6 samples of coffee soils from Madras, 4 of tea garden soils (with subsoils) from the Dooars, 9 of *bhil* or peaty tea soils, and 3 of *teela* or poor

sandy soils also used for the culture of tea;[1] and 5 samples of Poona (Manjri) farm soils, 3 (with subsoils) of Nagpur farm soils, 11 of Cawnpur farm soils, and 8 (with subsoils) of Dumraon farm soils.

Analyses are also reported of miscellaneous soils sent to the author for examination, as follows: Three samples of tobacco and onion soils near hot springs (with samples of the water), 3 of soil from the Dholkot forests, 35 of Meerut soils, and 6 of "chos" (sandy) soils.

In the type soils the proportion of insoluble silicates was very variable.

"In the soils of the great alluvial plains, their amount is much about the same as one is accustomed to find in English loams and clays. In the black cotton soil (*regur*) their amount is uniformly low, due principally to the high proportions of ferric oxid and alumina and the water combined with them, and to a lesser degree to the presence of larger amounts of lime and magnesia than many English loams contain. In the red soils of Madras the proportion of silicates is low in two cases, due to the presence of large amounts of iron and alumina; the other samples contain high amounts. The laterite soils yielded very varying amounts of insoluble silicates, which was due almost entirely to the great variations in the amount of iron and alumina which is a chief characteristic of these soils. In the brown alluvial soils from Madras Presidency, the proportion of silicates is low in the loams, chiefly owing to the high proportions of iron and alumina which these soils contain. In the coffee soils from the Sheveroys the silicates are very small in amount, due in part to high proportions of iron and alumina, but in part also to high proportions of organic matter. In the Assam soils the proportion varies very much, according to the proportion of organic matter present."

The iron and aluminum content was usually high. In the Indo-Gangetic alluvium the iron oxid varied from 2 to 7 per cent, the alumina from 3 to 10 per cent; in the regur soils the iron oxid varied from 4 to 11.5 per cent, the alumina from 6 to 14 per cent; in the red Madras soil the iron oxid varied from 3.5 to 10 per cent, the alumina from 1.5 to 15.8; and in the laterite soils the iron oxid varied from 6 to 48 per cent, the alumina from 7 to 14 per cent.

The soils are, as a rule, poor in lime, the alluvium containing from 0.3 to 2 per cent, the regur soils from 1 to 7.7 per cent, the red soils, laterites, and Madras alluvium usually less than 1 per cent. The coffee soils had about 0.3 per cent and many of the Assam soils even less. The amount of lime usually present is considered sufficient, especially in view of the fact that the humus content of these soils is, as a rule, quite low.

Magnesia is generally abundant and potash appears to be ample in all classes of soils.

"[Phosphoric acid is usually low]. Of the Gangetic alluvial soils, 6 contained 0.08 or less, 4 contained from 0.09 to 0.13, and only 2, namely, the Changa Manga soil and the calcareous one, both of which had been placed for long periods under influences of accumulation of plant food, contained more than 0.13 per cent. Of the 18 regur soils, 16 contained 0.08 or less of this plant food, the other 2 containing about 0.2 per cent. Of the 6 red soils, 4 contained 0.08 per cent or less, the remaining 2, 0.09

[1] The data regarding tea soils are quoted from K. Bamber's book "On the Chemistry and Agriculture of Tea."

per cent. Of the laterite soils, 4 contained less than 0.01 per cent, 4 others 0.08 per cent or less, and 4 others fair amounts. The Madras alluvial soils contained, as a whole, somewhat more, there being 0.08 per cent or more in 6 out of 10 samples, but the other 4 contained only very small amounts. The coffee soils have doubtless been well manured, and contained with one exception 0.1 per cent or more. The Assam soils appear to be far better off in respect of phosphoric acid than any other soils in India. In none of those examined could there be said to be a serious deficiency."

By digestion of some of the soils in 1 per cent citric acid, according to Dyer, it was found that "although the Indian soils have frequently or generally a low proportion of total phosphoric acid, it is likely that the proportion of available phosphoric acid is not usually deficient."

With the exception of Assam soils, there is usually little organic matter and nitrogen in Indian soils, under normal conditions.

"Among the soils representing the Gangetic alluvium, 3 out of 10 contain 0.05 per cent or a little more [of nitrogen], the rest less; among the alluvial soils from Madras, 2 contained about 0.1 per cent, and 2 contained about 0.05 per cent, but in the other 6 samples the proportion was much less. Of the 18 samples of regur soils, only 1 contained 0.05 per cent, the other 17 containing less; among the red soils from Madras 1 contained 0.05, the other 5 less; among the 12 laterite soils not one contained as much as 0.05 per cent, and most of them only about 0.03 per cent or less. On the other hand the Assam soils contained uniformly high proportions of nitrogen, and those soils which have had an opportunity of accumulating nitrogen contained very fair amounts. The soils from Partabgarh contained 0.18, the surface soil at Changa Manga 0.237, and the coffee soils from the Sheveroys 0.04 to 0.17."

The judging of the physical properties of soils by means of the heat which they evolve when moistened, A. MITSCHERLICH (*Jour. Landw.*, *46* (*1898*), *No. 3*, *pp. 255–268*).—This is essentially a summary of an inaugural dissertation presented at Kiel in 1898. When dry soils are moistened a certain amount of heat is evolved (*Benetzungswärme*). Wilhelmy[1] has shown that the amount of heat thus evolved depends upon the size, form, and adhesion coefficient of the individual soil particles.

The author undertook to determine whether this property of soils could be used for comparing their physical properties. For this purpose 10 typical soils, classified on the basis of their actual agricultural value as determined in practice, were subjected to mechanical and chemical analysis and also tested with regard to the heat evolved on moistening. The samples used for analysis were put through a sieve having round holes 1.5 mm. in diameter, and air-dried to constant weight. The moisture was determined in 5 gm. of the air-dry material by drying in a vacuum over strong sulphuric acid. The Schloessing method of analysis was followed in the main. Humus, however, was calculated by Wolff's factor, 1.724, from the carbon as determined by Loges' method.[2] In case of soils rich in humus the portion separated as clay in mechanical analysis contained considerable amounts of humus. A

[1] Ann. Phys. u. Chem. [Poggendorff], 119 (1828), p. 177; 122 (1829), p. 1.

[2] Landw. Vers. Stat., 28 (1883), p. 229.

correction was therefore made for this as determined by loss on ignition. The heat evolved on moistening the soils was determined by means of a Bunsen[1] ice calorimeter as improved by Schuller and Wartha,[2] the method of procedure being in brief as follows:

The soil was dried over concentrated sulphuric acid. A sample of the dried soil was placed in a suitable glass vessel, which was closed with a stopper carrying a capillary tube, through which the air was exhausted. At the end of this operation the capillary tube was sealed and the vessel containing the soil was cooled and placed in the inner chamber of the calorimeter, which was filled with pure distilled water. The capillary tube was broken under water, thus letting in the water and moistening the soil, and the rise in temperature was noted.

The rise in temperature (uncorrected for errors in manipulation, etc.) varied from 0.001 calorie (small) in tertiary quartz sand to 22.66 calories in moor soils. The heat evolved appeared to be more largely influenced by the stage of decomposition of the humus in the soils than by any other factor. The more advanced the decomposition the higher the temperature noted. There appeared to be no relation between the heat evolved and hygroscopicity.

It is claimed that the determination of the heat evolved when soils are moistened is more easily and correctly carried out than the chemical and mechanical analysis, and that it furnishes more reliable indications of the actual agricultural value of soils.

The carbonic acid of the atmosphere, ALBERT-LEVY and H. HENRIET (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 23, pp. 1651–1653*).

Carbonic acid of the air, ALBERT-LEVY and H. HENRIET (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 7, pp. 353–355*).

On the probable occurrence of a hitherto unknown substance in the atmosphere, O. NEVVINS (*Ann. Phys. u. Chem., 1898, No. 9, pp. 162–169*).

The purification of potable waters, P. GUICHARD (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 13, pp. 588–592*).

Soil temperatures at Lund, Sweden (*Meddel. K. Landtbr. Styr., 7 (1897), No. 42, p. 183*).—Monthly observations of the soil temperature at one-half and 1 meter depths for the year 1896.

On the differences in temperature of soils with and without vegetation or a covering of snow, H. WILD (*Separate from Mem. Acad. Imp. Sci. St. Pétersbourg, 1898, pp. 32. Leipsic*).

Moisture investigations for 1897, E. C. CHILCOTT and A. B. HOLM (*South Dakota Sta. Bul. 58, pp. 55–84, figs. 5*).—This bulletin records the results of the determination of moisture at 4 different depths in 10 tenth-acre plats subjected to different systems of culture—wheat, raked, shallow culture, deep culture, and no cultivation, together with some data relating to the mechanical analysis of the soils of the different plats, the meteorological conditions of the season, and the temperature of the soil at different depths.

On the nitrogenous products which accompany humic acid in peat, F. SESTINI (*L'Orosi, 21, p. 1; abs. in Bul. Soc. Chim. Paris, 3. ser., 20 (1898), No. 13, p. 574*).—The author boiled peat for several hours successively with 2 per cent sodium hydrate and

[1] Ann. Phys. u. Chem. [Poggendorff], 141 (1870), p. 101.

[2] Ann. Phys. u. Chem. [Wiedemann], n. ser., 2 (1887), p. 359.

10 per cent hydrochloric acid, but succeeded in removing only a small proportion of the nitrogenous substances present, thus showing that amids are not present to any great extent, as is commonly supposed. It was also found that natural humus compound prepared from peat, as well as artificial humus prepared from pure sugar, yielded furfurol when heated with hydrochloric acid.

FERTILIZERS.

Experiments with lime on acid soils, F. S. Earle and A. W. Orr (*Alabama College Sta. Bul. 92, pp. 107–112, fig. 1*).—A brief account is given of experiments in the greenhouse and in the field on the effect of lime on the Gulf sandy coast soils of Deer Park, Alabama. The 3 soils used in the greenhouse experiments were (1) ordinary upland soil of the coast region, quite sandy and rather deficient in humus; (2) so-called "Savannah land," a light gray sandy loam, usually too wet for cultivation without drainage; (3) stiff black soil from a swampy hammock—the low lying timber lands along small streams. The 3 samples represent the prevailing types of coast soils. All of them gave a prompt and decided acid reaction with litmus paper.

"A portion of each lot [of soil] was fertilized with cotton-seed meal and placed in a shallow box, 20 by 36 in., having a partition dividing it into 2 equal parts. On one side of the partition in each box a quantity of slacked lime was dug into the soil, the other side being left without lime. The boxes were watered and left on the greenhouse bench till January 1. On again testing with litmus paper, the limed ends of the boxes now gave a strong alkaline reaction. The boxes were planted to American Wonder peas. It soon became evident that too much lime had been used, for after coming up, the peas in the limed ends of the boxes all died. They did not seem able to strike root in the soil. The boxes were replanted at intervals, but without success, until about the middle of March, when they were planted to lettuce and radishes. On April 2 it was noted that at last a good stand had been secured in 2 of the limed boxes. The one containing the upland soil was still a complete failure. In box No. 3, with the hammock soil, the lettuce was decidedly best in the limed end; no difference could be noted in the radishes. In box No. 2, the Savannah soil, the lettuce was at least 3 times as large in the limed end, while the radishes seemed hardly so good with the lime. The radishes continued to grow luxuriantly in both ends of both boxes, but at maturity they were slightly better in each case in the limed ends. With the lettuce the difference was very marked. In the unlimed ends of both boxes it was stunted and sickly, with leaves less than 2 in. long, but in the limed ends it grew rank and luxuriant."

Experiments were made in the field on upland soil at Deer Park with peas, corn, German millet, tomatoes, beans, ruta-bagas, lettuce, egg-plant, sorghum, peanuts, tobacco, okra, potatoes, flax, Kafir corn, and cucumbers. The soil was limed at rates of from 15 to 45 bbl. per acre. For various reasons the results with the majority of the crops were inconclusive. Corn, tomatoes, lettuce, and tobacco, were, however, strikingly benefited by liming. It was noted that the tomatoes on the heavily limed plat were free from blight or bacteriosis.

On the influence of crops and manure on the nitrogen content of soils, C. F. A. Tuxen (*Tidsskr. Phys. og Chem., 2 (1898), p. 168; abs. in Chem. Ztg., 22 (1898), No. 71, Repert., p. 219*).—The experiments made by

the author lead to the conclusion that the nitrogen content of soils is increased by culture of leguminous plants due to the assimilation of the free nitrogen of the air by such plants. Grass is especially effective in protecting the soil from loss of nitrogen by washing and by decomposition. The cereals, on the other hand, rapidly reduce the nitrogen content of the soil. Experiments during from 20 to 30 years with different kinds of fertilizers and manures have shown that the application of commercial fertilizers containing nitrogen does not increase the store of nitrogen in the soil. The use of barnyard manure, however, has, in every case, resulted in a decided increase in this respect.

On the production of barnyard manure, P. GAY and DUPONT (*Ann. Agron., 24 (1898), No. 3, pp. 123–130, fig. 1*).—For the purpose of determining the comparative losses of nitrogen when manure is removed from stables only at long intervals and when it is removed daily, the authors first determined the amount of nitrogen consumed in the food and excreted in the urine and feces of a sheep during 7 days. The food used was alfalfa and oats. The feces and urine were collected by means of rubber bags and harness. The total nitrogen in the food consumed during the 7 days was 171.1 gm. The amount excreted (98 gm. in the urine and 65.4 in the feces) was 163.4 gm. The amount of nitrogen not recovered in the urine and feces was therefore 7.7 gm. or 4 per cent of the amount in the food.

In the second experiment the same animal was kept for 14 days in a stall, being supplied each day with sufficient litter to absorb all urine. The nitrogen in the food consumed was 345.1 gm., in the litter used, 53.1 gm., and in the manure produced, 321.9 gm. The loss of nitrogen was therefore 76.3 gm. or 22 per cent of the original nitrogen. These results confirm in general those obtained by Müntz and Girard (E. S.R., 4, p. 686.)

Fertilizers (*New Jersey Stas. Rpt. 1897, pp. 15–75*).—Much of the data in this article has already been published (E. S. R., 9, p. 934). Statistics are given showing the quantity and value of fertilizers used in New Jersey in 1896, and comparing the trade of this year with that of preceding years. The market prices of various fertilizing materials are reviewed, with trade values of fertilizing ingredients for 1897; and analyses and valuations are given of 453 samples of fertilizing materials, including nitrate of soda, sulphate of ammonia, dried blood, dried and ground fish, tankage, ground bone, dissolved boneblack, dissolved South Carolina rock and other mineral phosphates, muriate of potash, sulphate of potash, kainit, double sulphate of potash and magnesia, wood ashes, tobacco stems, marl, garbage fertilizer, wool combings, screenings, mussels, granulated tobacco and sulphur, and home-mixed and factory-mixed fertilizers.

From replies to a circular sent to firms selling fertilizers in New Jersey it appears that the total consumption of fertilizers in the State during 1896 was 56,355 tons, valued at $1,612,718, complete manures representing 77 per cent of the total amount and 81 per cent of the total

value of all sales. The sales reported in 1896 were larger than those of any previous year. A comparison of the average composition of the 331 fertilizers examined in 1896 with the averages for previous years "indicates that no decided change in the average quality of fertilizers has occurred during the past 12 years."

A review of market prices of fertilizing materials for 7 years shows that the difference between the wholesale and retail prices of nitrogen in 1896 was 19.3 per cent. "This is a marked decrease from that of last year, but is still too great. It is largely due to the low wholesale prices which ruled for all ammoniates during 1896. In the case of available phosphoric acid the difference is nearly 90 per cent greater than in 1895, while in potash there is a decrease of over 12 per cent." The average valuation of mixed fertilizers remains about the same as in previous years. "The average selling price, however, is now lower than ever before, which reduces the amount of average charges for mixing, bagging, shipping, and selling to $7.70 per ton, or 35.7 per cent, which is less in amount than in any of the previous 6 years." The average composition of 35 samples of ground bone examined during the year was: Nitrogen, 3.51 per cent, and phosphoric acid, 24.67 per cent, the average retail selling price being $28.88. Ten of the 35 samples failed to reach their guarantees in either nitrogen or phosphoric acid and 1 was low in both constituents. With one exception, however, any deficiency in one element was more than made up by an excess in the other.

Algerian phosphate production (*Engineer. and Mining Jour., 65 (1898), March 12, p. 313; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 3, p. 291*).—Statistics are reported which show that the shipment of Algerian phosphate from the port of Bône in 1897 was 207,083 metric tons as against 140,040 tons in 1896. England, France, Germany, and Italy, with 73,430, 70,155, 24,770, and 18,950 tons, respectively, were the largest consumers of this product.

Sulphate of ammonia production (*Engineer. and Mining Jour., 65 (1898), June 18, p. 730; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 6, p. 622*).—The production of this material in Great Britain in 1897 is stated to have been 198,280 long tons, and in the United States 3,111 tons.

Nitrate of soda and sulphate of ammonia (*Bradbury and Hirsch's Report; W. Montgomery & Co.'s circular; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 1, pp. 84–86*).—Statistics of consumption, prices, etc., for the period from 1893–1897.

Experiments with potassium perchlorate, JUNGER and M. GERLACH (*Jahresber. Landw. Vers. Stat. Jersitz-bei-Posen, 1897–98, pp. 29–33*).

On the agricultural value of Solvayhall "hartsalz," M. MAERCKER (*Illus. Landw. Ztg., 18 (1898), p. 618; abs. in Chem. Ztg., 22 (1898), No. 71, Repert., p. 219*).—This salt, which is rich in chlorin, was compared with kainit and sulphate and chlorid of potash in pot and field experiments. As a rule the hartsalz gave larger yields than kainit, more potash but less chlorin being taken up by plants in case of the former than in case of the latter. The potash in the hartsalz appeared to be fully as soluble as that in kainit and more soluble than that in sulphate.

The law of the minimum and the effects of excessive liming, L. GRANDEAU (*Jour. Agr. Prat., 62 (1898), II, No. 38, pp. 405–407*).—Attention is called to the necessity of keeping limed soils well supplied with phosphoric acid, potash, and especially nitrogen.

A special method of applying fertilizers by diffusion, A. HÉBERT and G. TRUFFAUT (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 11, pp. 651-655*).—The method tested by the author consists in mixing the soluble fertilizing materials with variable amounts of inert substances, such as kaolin, or clay, and pressing the mixture into pellets, which are buried in the soil either without an envelope or wrapped in different numbers of layers of metallic foil. The results indicate that by this method the rate of diffusion of the fertilizing material may be controlled.

On the control of fertilizers during 1897, M. WEIBULL (*Contribution from Alnarp laboratory IX; Tidskr. Landtmän, 19 (1898), No. 5, pp. 75-78*).

Tabulated analyses of commercial fertilizers, T. J. EDGE and W. FREAR (*Pennsylvania Dept. Agr. Bul. 37, pp. 40*).—This bulletin gives the text of the State fertilizer law, notes on valuation, and tabulated analyses and valuations of 588 samples of fertilizing materials inspected during the period from January 1 to August 1, 1898.

Analyses of commercial fertilizers, B. W. KILGORE ET AL. (*Mississippi Sta. Spec. Bul. 49, pp. 27*).—This bulletin reports analyses and valuations of 176 samples of fertilizing materials inspected by the State chemist during the season of 1897-98, introduced by explanations of terms used in stating the results of analyses, notes on the valuation of fertilizers, and the text of the State fertilizer law.

Analyses of fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 51, pp. 12*).—Trade values of fertilizing ingredients in 1897 and tabulated analyses of 94 samples of fertilizing materials, including muriate and sulphate of potash, ashes, sulphate of ammonia, ground tobacco stems, cotton-seed meal, bone, ground fish, whalebone scrapings, muck, barnyard manure, and mixed fertilizers.

Analyses of fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 54, pp. 24, pl. 1*).—This bulletin gives a schedule of trade values of fertilizing ingredients in raw materials and chemicals in Massachusetts for 1898 and tabulated analyses of 166 samples of fertilizing materials, including wood ashes, lime-kiln ashes, ashes from garbage crematories, phosphatic slag, bleachery refuse, meat meal, blood and bone, tankage and ground bone, cotton-seed meal, tobacco refuse, wool waste, "teopik" fiber, mixed feed, broom-corn seed, acid phosphates, nitrate of soda, muriate of potash, sulphate of potash, and mixed fertilizers.

FIELD CROPS.

The effect of certain methods of soil treatment upon the corn crop, T. L. LYON (*Nebraska Sta. Bul. 54, pp. 77-89, map 1*).—This bulletin discusses the moisture conditions of the State, gives a geological classification of the soils of Nebraska, and reports the results of experiments on subsoiling, fall and spring plowing, deep and shallow plowing, and subsurface packing for corn. Comparisons were made of listing and check-rowing the crop, and giving deep and shallow cultivation.

Experiments in subsoiling have been carried on for several years and some of the results have been previously reported (E. S. R., 7, p. 847). The results obtained at the station on a loam containing alkali and underlaid with a compact subsoil showed that subsoiling increased the yield in most cases, but when the season was very wet spring subsoiling failed to show any benefit. Subsoiling in western Nebraska, where the subsoil was loose and porous, reduced the yield by about one-half. The results of subsoiling obtained by farmers throughout the State are reported. On clay subsoil 80 per cent of these trials were favorable to subsoiling, but on a loam subsoil only 23 per cent. In 8 cases of the 59

reported the effect of subsoiling was unfavorable the first year, but favorable afterwards, and in 4 cases the beneficial effect disappeared by the third year.

Fall plowing gave better results than spring plowing, but in 2 of the 4 tests made the results were nearly alike. On the soil at the station plowing early in the fall or in the summer was more effective in increasing the yield than plowing late in the fall. "If the plowing be done in the fall the soil is well compacted by spring, which is doubtless the main reason that fall plowing of this soil produces better results than spring plowing." Land plowed 4 in. deep, both in the fall and in the spring, gave a better yield than land plowed 8 in. deep. It was found that discing 3 in. deep for corn in the fall gave better returns than discing 6 in. deep, but it was not as effective as shallow plowing.

Subsurface packing the soil at the station according to the Campbell method of soil culture decreased the yield when it was done in the fall, but produced an increase when done in the spring. The process of subsurface packing is described.

At the station corn planted in rows both ways on land plowed 8 in. deep yielded 30 bu. per acre and listed corn yielded 18 bu., while on light soil in the western part of the State listed corn yielded 40 bu. per acre and corn grown by the other method 38 bu. Cultivating corn during its growth to a depth of 3 in. gave much better results than cultivating about 6 in. deep.

Preservation of corn stover, D. O. NOURSE (*Virginia Sta. Bul. 73, pp. 15–18*).—This article is a brief discussion on the preservation of corn stover, with directions for cutting, shocking, and storing. The experience of the station has been that shocks made 12 hills square are most economical in every way. Fodder has been kept in the rick all winter covered with but a little straw and was found in perfect condition when placed in the barn the following spring. "To keep it thus . . . time must be allowed for the fodder to cure in the field and it must be placed in the barn or rick entirely free from moisture."

An experiment with clover, F. W. RANE (*New Hampshire Sta. Bul. 48, pp. 122–125, figs. 3*).—In 1896 clover was grown from spring seeding on 2 plats each located in a well-fertilized field. One of the plats had been in corn the year previous, while the other had not produced a hoed crop. The seed sown per acre consisted of 3 pk. of barley, 5 lbs. alsike clover, 7 lbs. red clover, 5 lbs. redtop, and 12 lbs. of timothy. "When the barley, which was used for the protective crop, was cut for hay the clover had made an excellent growth." The field which had produced corn the year before yielded at the rate of 8,835 lbs. of hay per acre, and the other field gave a yield of 9,360 lbs. per acre.

A preliminary report on the experiments with forage crops, T. L. LYON (*Nebraska Sta. Bul. 53, pp. 65–76*).—This bulletin discusses the forage conditions of the State during the summer months and

reports the results of experiments in pasturing and in growing a number of forage crops for pasture and soiling purposes. Descriptive and cultural notes are given for each crop. A two-year-old heifer, not giving milk and weighing about 800 lbs., was pastured on plats of rye and sorghum to ascertain the amount of land required to sustain a cow during summer. The results obtained are given in the following table:

Length of time an acre of rye or sorghum furnished pasturage for one cow.

	Pasturage per acre for 1 cow.		Pasturage per acre for 1 cow.
	Days.		*Days.*
Rye (winter rye sown in spring)	129	Sorghum 5 ft. high	127
Sorghum $2\frac{1}{2}$ ft. high	90	Sorghum, heads formed	99
Sorghum $3\frac{1}{2}$ ft. high	109	Sorghum, seeds ripe	72
Sorghum $4\frac{1}{2}$ ft. high	127	Sorghum, second growth	136

Among the forage crops tested sorghum, red and white Kafir corn, Canada field peas, hairy vetch, burnet, Jerusalem corn, millo maize, soja beans, and cowpeas are considered adapted to the climate and the soil and of some value as forage. The yields and the food ingredients per acre produced by some of these crops are given in tables. The significance of the different food constituents is explained in a popular way.

On the change of the composition of green fodders at different periods of vegetation, P. AZARYEVICH (*Zapi. Novo-Alexandria; Inst. Selsk. Khoz. i Lyesov., 10 (1897), No. 2, pp. 19–21*).—A small plat of ground was sowed with *Vicia narbonnensis;* the development of the plants proceeded normally. The Vicia was mowed at intervals of 2 weeks, and the plants were dried and analyzed. The author concludes that the content of the crude protein in Vicia continually decreases during the period of vegetation.

The amount of albuminoids gradually decreases with age, but in comparison to the crude protein it increases. This is explained by the transformation during growth of nonalbuminous bodies into albuminous, a transformation which is less pronounced in the case of Vicia than in that of the Gramineæ.

Concerning the ash, no regularity was observed in the change of the percentage content until flowering, after which period there was a continual decrease.

The content of fat remained unchanged until flowering, after which it gradually decreased.

The amount of cellulose continually increased with the growth of the plants.

There was a continual though slight increase in the nitrogen-free extract.

The sum of the nitrogen-free extract plus the fat increases until flowering, but decreases after flowering. This is in entire agreement with the results of E. Wolf and Ritthausen, who experimented with red clover and alfalfa.—P. FIREMAN.

Cooperative fertilizer experiments with cotton in 1897, J. F. DUGGAR (*Alabama College Sta. Bul. 91, pp. 43–103*).—Fertilizer experiments were made in 30 localities of the State to determine the best fertilizer for the different soils. Of the reports received 20 gave definite indications, and these are discussed at length and tabulated in detail, while those deemed inconclusive are considered briefly. Similar experiments were conducted in 1896 (E. S. R., 9, p. 126).

In all experiments cotton seed meal and acid phosphate were applied at the rate of 200 and 240 lbs. per acre, respectively. Kainit was applied at the rate of 100 and 200 lbs. per acre. The fertilizers were applied singly, in twos, and altogether. The application of 200 lbs. cotton-seed meal, 240 lbs. acid phosphate, and 100 lbs. kainit per acre gave the best financial results in the greatest number of localities.

Seeding grass without grain, C. B. LANE (*New Jersey Stas. Rpt. 1897, pp. 190, 191*).—A grass-seed mixture of red clover, alsike clover, and timothy was sown during the summer on 3 well prepared and manured fields. The first field had been in grass for 4 years, the second had produced oats and potatoes, while the third had yielded a crop of oats. A mixture of ground bone, muriate of potash, and acid phosphate was applied to the different fields at the rate of 400, 250, and 500 lbs. per acre, respectively, but the land which had produced potatoes, having been manured for that crop, received no fertilizer before the grass seed was sown. The first field yielded 3.2 tons of cured hay the following June; the 2 other fields yielded 2.5 and 2.1 tons of hay, respectively.

Commercial fertilizers for potatoes, W. H. JORDAN (*New York State Sta. Bul. 137, pp. 605–624*).—The work here reported is similar to previous experiments (E. S. R., 9, p. 128). Fertilizer experiments including 8 acres of land and 80 plats were made with potatoes on 4 farms on Long Island. Four different fertilizer formulas were applied at the rate of 500, 1,000, 1,500, and 2,000 lbs. per acre. Formula No. 1 consisted of 192 lbs. nitrate of soda, 800 lbs. high-grade dried blood, 570 lbs. acid phosphate, 400 lbs. muriate of potash, and 38 lbs. land plaster, aggregating 2,000 lbs. and containing 6.6 per cent nitrogen, 4.75 per cent available phosphoric acid, and 10.31 per cent of potash. This formula was made up with reference to the composition of the potato plant, excepting that the phosphoric acid was in considerable excess. Formula No. 2 was similar to No. 1 with the exception that the potash was supplied as the sulphate. Formula No. 3 was composed of 127 lbs. nitrate of soda, 440 lbs. high-grade dried blood, 1,000 lbs. acid phosphate, 400 lbs. muriate of potash, and 33 lbs. land plaster, also aggregating 2,000 lbs. This mixture contained 3.8 per cent of nitrogen, 8 per cent available phosphoric acid, and 10.4 per cent potash, and was made up in imitation of a fertilizer much used on Long Island. Formula No. 4 was similar to No. 3 but the potash was supplied as sulphate. In these different formulas approximately one-fourth of the nitrogen was nitric and the rest organic and the phosphoric acid was as largely soluble as possible.

The yields and composition of the crop are given in tabular form. The author summarizes the results as follows:

"The use of 1,000 lbs. of fertilizer per acre gave the greatest profit. The slightly larger yield caused by increasing this application to 1,500 or 2,000 lbs. cost in fertilizer expense considerably more than the market value of the potatoes.

"The fertilizer cost of the increased yield of potatoes where 500 or 1,000 lbs. of fertilizer was used per acre was 20 cts. per bushel in those experiments that proceeded without unfortunate conditions.

"The yield of tubers from the Long Island formula was somewhat larger than from a formula compounded with reference to the composition of the potato plant.

"The evidence obtained in these experiments concerning the relative effect of the muriate and the sulphate of potash upon the composition of the potato tuber is inconclusive.

"The proportions of the valuable plant-food compounds found in the potato tubers were not influenced appreciably by the amount or kind of fertilizer used."

A study of the barleys of Tunis and Russia, P. PELLETIER (*Separate from Rev. Serv. Intendance Mil. Paris, 1898, pp. 39*).

The introduction of clover and the potato into Europe, G. REISCHEL (*Natur, 47 (1898), No. 30, pp. 349–353, figs. 2*).

The culture of maize for meal and fodder in Germany, A. VON LENGERKE (*Anleitung zum Anbau des Mais als Mehl und Futterpflanze in Deutschland. Berlin: Paul Parey, 1898, pp. 57, figs. 19*).—Third edition by C. J. Eisbein.

Cotton and cotton goods in Japan, H. N. ALLEN (*U. S. Consular Rpts. 1898, No. 216, pp. 30, 31*).—The imports of raw cotton into Japan for 1897 are given in a table.

Two useful grasses (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 4, pp. 289–291, figs. 2*).—Notes on *Paspalum distichum* and *P. dilatatum*.

The two best grasses of our meadows, E. PIRET (*Agronome, 1898, No. 29*).

Quickens, scutch, couch, J. R. CAMPBELL (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 84–96, figs. 3*).—A description of a number of grasses which propagate by means of underground stems and of the methods for their prevention and eradication.

Hints on laying down land to grass, W. ADAMSON (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 3, pp. 524–531*).—General directions for sewing grass seeds, with brief notes on a number of grasses and clovers, describing the different species and pointing out their merits.

On the treatment of permanent artificial and natural pastures, S. AANESTAD (*Norsk Landmandsblad, 17 (1898), No. 29, pp. 312–314; Tidsskr. norske Landbr., 5 (1898), No. 9, pp. 407–426*).

The Scandinavian method of haymaking, J. SPEIR (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 80–84, fig. 1*).—A description of the method and directions for constructing the necessary drying racks.

Fertilizer experiments with degelatinized bone meal on meadows and clover fields, M. ULLMANN (*Ztschr. Öffentl. Chem., 4 (1898), p. 272*).

Artificial fertilizers vs. Ceres treatment for mangolds, L. J. JENSEN (*Landmandsblade, 31 (1898), No. 10, pp. 132, 133*).

On pea and vetch culture, H. TEDIN (*Landtmannen, 9 (1898), No. 26, pp. 413–417; 27, pp. 433–435; 29, pp. 472–474; 30, pp. 480–485*).

Comparison of varieties of potatoes, F. W. RANE (*New Hampshire Sta. Bul. 48, pp. 125–130, map 1*).—A report on cooperative variety tests with potatoes. A wet season interfered with the experiments.

Vegetative propagation of potatoes, A. SEMPOLOWSKI (*Deut. Landw. Presse, 25 (1898), No. 45, pp. 490, 491*).—Experiments in grafting plants of certain varieties of potatoes on plants of other varieties, and of tomato plants on potato plants, in uniting parts of potato tubers of certain varieties with parts of tubers of other

varieties, and in transplanting the eyes of potato tubers into tubers of other varieties, as a means of securing new varieties, are reported. No graft hybrids were produced and no interaction of stock and scion noticed.

Fertilizer experiments with potatoes, roots, and cabbage at Kalnäs Agricultural School, 1897, K. DÖHLEN (*Norsk Landmansblad, 17 (1898), No. 20, pp. 211–214*).

Profitable potato fertilizing, F. H. HALL (*New York State Sta. Bul. 137, popular ed., pp. 5*).—For abstract of New York State Sta. Bul. 137, see p. 431.

The culture of sainfoin or esparcet, A. LONAY (*Agronome, 1898, No. 18*).

The growth of sugar beets and the manufacture of sugar in the United Kingdom, J. B. LAWES and J. H. GILBERT (*Jour. Roy. Agr. Soc., England, 3. ser., 9 (1898), Pt. II, pp. 344–370*).—This article is a discussion of the Rothamsted experiments with sugar beets from 1871 to 1875; the beet-sugar industry on the continent of Europe, with special reference to Germany and France; the value of sugar beets according to their composition, and of the growth of the sugar beets and the manufacture of beet sugar in the United States. A consideration of the prospects of the beet-sugar industry in England is based on the facts presented.

Sugar cane, U. CAVALCANTI (*Bol. Inst. Agr. Estado de São Paulo em Campinas, 9 (1898), No. 3, pp. 107–123*).

A study on the culture of the sweet potato, C. ARÈNE and E. CROUZEL (*Étude sur la culture de la patate (Convolvulus batatas). Paris: Société d'éditions scientifiques, 1898, pp. 24*).

Report on experiments with wheat, oats, colza, sugar beets, and fodder crops, and on investigations in stock feeding in 1897, A. HOUZEAU (*Rapport sur les champs de démonstration blé, avoine, colza, betteraves à sucre, betteraves fourragères, herbages, alimentation nationelle de bétail. Rouen: Impr. Gy, 1898, pp. 33*).

Germany's straw industry, J. C. MONAGHAN (*U. S. Consular Rpts. 1898, No. 216, pp. 52, 53*).—The article enumerates the various articles made out of straw and describes how the grain should be grown when the straw is to be used for this purpose. The straw used is mainly rye and wheat straw.

Special products of the farm (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 3, pp. 492–515, fig. 1*).—A compilation of cultural notes of fodder, forage, and fiber plants. The culture of sugar beets, rape, and potatoes is treated at some length.

Descriptive notes on the agricultural areas and Crown lands open for selection, L. LINDLEY-COWEN (*West Australian Settler's Guide and Farmer's Handbook, pt. 1, pp. 204 + 23, pls. 10, fig. 1, maps 3, dgm. 1. Perth: E. S. Wigg & Son, 1897*).—An enumeration of the productive possibilities of Western Australia, issued under the direction of the Bureau of Agriculture. Customs, statistics, land laws, and stock quarantine regulations are given in an appendix.

Irrigation (*New Jersey Stas. Rpt. 1897, pp. 103–108, fig. 1*).—A description is given of 2 irrigation plants installed in New Jersey during 1897, one at Vineland and the other at the New Jersey Training School for Feeble-Minded Children. The results obtained with these plants "show that artificial watering can be used to advantage even in a wet season."

HORTICULTURE.

Report of the assistant in horticulture, A. T. JORDAN (*New Jersey Stas. Rpt. 1897, pp. 111–159, pl. 1*).—The treatment given the permanent experimental plats during the year is noted. Yields of 4 varieties of currants and 4 varieties of gooseberries grown on irrigated and unirrigated plats are tabulated. The growth of 3 peach trees set by the Stringfellow method is compared with that of 3 set by the usual method. A study has been started to determine the annual draft of

young fruit trees on the nitrogen, phosphoric acid, and potash of the soil. A table is given showing the weight of the leaves and the total length of growth of branches of various tree fruits for the years 1896 and 1897. A test was made of the effect of irrigation, the relative effect of fertilizers with and without irrigation, and the effect of different fertilizers on strawberries. The yields of the different plats are given in tabular form.

> "These results show that in 11 cases the yield is increased by irrigation, while in the other 13 no increase occurs; and that in 2 cases the yield from the plats receiving the complete fertilizer is increased by irrigation, while it is less in the other 4; that with the mixture of bone, potash, and acid phosphate the yield, with one exception, is increased by irrigation, while when nitrate of soda is added to the complete fertilizer, only 1 instance of increased yield occurs."

The effect of nitrate of soda was shown in darker foliage and almost entire freedom from rust. The different fertilizers both with and without irrigation did not appreciably influence the time of ripening. In connection with the irrigation tests the daily and monthly rainfall of the years 1896 and 1897 is recorded.

A comparison was made of hill culture with matted-row culture of strawberries. The plants of 5 plats were grown in hills varying from 12 to 24 in. apart each way. The plants of the other 3 plats were set 18 in. apart in rows 4 ft. apart. In one of these plats all the runners were allowed to grow and form a matted row. In another one-half of the runners were removed, and in a third but 2 plants were allowed to grow from each one set. The varieties grown were Lady Thompson, Greenville, and Gandy. The yields per plant, per plat, and per acre, are given in tables. In the case of hill culture the largest yields were obtained from the plats in which the plants were set 12 in. apart and with 2 exceptions there was a regular gradation in the yields of all varieties from the 12 in. plats to the 24 in. ones. The maximum yield per hill was obtained from the 15 in. plat. The 12 in. plat yielded more than any of the systems of matted-row culture. Of the latter the plat in which all runners were allowed to remain gave the largest yield and the one in which only 2 plants were allowed to form from each one set gave the smallest yield. There was no constant difference in size of fruits between the hill and matted-row system of culture. With the varieties Greenville and Gandy the matted-row plats gave the greatest early yield, while with the variety Lady Thompson the reverse was true.

A test of 31 varieties of strawberries is reported, the results being given in tables, showing early yield, total yield, size of fruits, production of runners, and freedom from rust. A few of the newer varieties are described.

Practical suggestions as to methods of management of apple orchards are reprinted from Bulletin 119 of the station (E. S. R., 9, p. 47), which gives data regarding apple culture obtained from a fruit survey of the State in 1895. Statistics on strawberries, raspberries, blackberries, currants, and gooseberries were gathered at the same time and are

reported in the present publication. Each of the fruits is considered separately. The number of growers using clay-loam soils and sandy soils, and the average yields on both soils in the years 1893 and 1894 are reported. The heavier soils as a rule gave considerably larger yields than the light ones. The number of varieties of each fruit grown in the State is noted, and a list of the varieties most grown in the different sections of the State is given, together with the number of growers reporting each variety. The report also records and discusses statistics in regard to methods of cultivation, manuring, the prevalence of insect enemies and diseases, the average yields, expenses, returns, and like data. Some practical suggestions are given on the culture of the various fruits mentioned.

Experiments in shading, B. D. HALSTED (*New Jersey Stas. Rpt. 1897, pp. 344–354, figs. 6*).—To test the effect of shade on the prevalence of fungus diseases a number of garden crops were shaded by lath screens. The screens were supported on stakes at various heights above the soil, depending on the size of the plants shaded. Between each 2 laths of the screen an open space equal to the width of a lath was left. The screens were put in position as soon as the seeds were sown.

Shading was found to affect the time of germination of seeds quite noticeably. With the first crop of Lima beans the seeds planted in the open had germinated well by May 26, while under the screens germination had failed almost entirely. The author believes the failure due to the low temperature of the shaded soil. With the second crop, when the conditions were changed, the shaded soil being warm and moist and the exposed soil hot and dry, the beans germinated much sooner in shade than elsewhere. In the case of bush beans observations made May 26 showed that the foliage of the shaded plants was darker in color than that of the unshaded plants, their first pair of leaves were longer, the third leaf was less advanced, the stems were shorter, and the roots had much fewer tubercles. Leaves of shaded turnips were darker green, less blighted, and less hairy than those of the unshaded plants and the roots of the shaded plants were considerably smaller. Shaded potatoes produced weaker vines than others and were kept free from Phytophthora longer. Club root of turnips and scab of potatoes was uninfluenced by shading. No marked effects were observed in case of onions. The first crop of peas germinated quicker in the open than under screens. The vines grew somewhat higher and produced fewer pods in the shade than in the full sunlight. The plants of the second crop were less fruitful and also less blighted in the shade than elsewhere; no difference in germination was noticed. Shaded carrots produced more foliage but much smaller roots than unshaded ones. The blight was also apparently checked by shading. Shaded plants of the second crop of lettuce were much larger and better than unshaded ones. The author believes the differences would have been

greater had not the summer been unusually wet and cool, and that shading will be found of great benefit in growing midsummer lettuce. Shading Swiss chard gave results similar to those obtained with lettuce, and in addition reduced the injury from leaf blight. Celery was affected by shading more noticeably than any other plants. "Six varieties were tested in this way and all grew to more than double the size of other plants of the same lot that were in the full sun, but later in the season, with shorter days and less light, the exposed plants overtook and surpassed the shaded ones." With 6 varieties of bush beans the weight of the whole crop of vines and pods of unshaded plants was somewhat greater than of shaded ones, but the weight of pods alone was greater in the case of shaded plants. At the time of harvesting there were 5 times as many ripe as green pods in the sun and not twice as many in the shade. The late varieties held their foliage about equal in both cases, but the early varieties had many more green leaves in the shade than elsewhere. With the second crop of bush beans grown in the same plats as the first the shaded plants were a little later in blooming than the unshaded ones, had fewer and larger leaflets, and were of a deeper green color. The shaded plants were unaffected by the first few frosts in fall, which killed the exposed plants. Other differences were noted with a number of vegetables tested, as diminished thickness of leaves in shade, etc.

The average monthly temperature of the air 1 ft. above the soil is reported to be from 4 to 11.6° cooler under the screens than in the open air, the difference increasing as the summer advanced. The extreme difference ranged from nothing on rainy days to 21° in the hottest clear weather.

Variety tests of fruits, S. T. MAYNARD (*Massachusetts Hatch Sta. Bul. 52, pp. 3–11, fig. 1*).—A report of variety tests of a number of orchard and small fruits is given. Only those varieties found to possess superior qualities are reported. The treatment given each fruit is noted. With some of the fruits the results of the tests are given in tabular form. The following varieties have given the best results: *European plums.*—Czar, Lincoln, German Prune, Kingston. *Japanese plums.*—Red June, Abundance, Georgeson, Burbank, Chebot, Satsuma. *Cherries.*—Early Richmond, Montmorency, Royal Duke, Black Tartarian, Napoleon, Governor Wood, Smidt, Windsor. *Grapes.*—Green Mountain, Herbert, Warden, Moore Early, Concord, Delaware, Brighton. *Currants.*—Cherry, Fay Prolific, Versailles, Red Cross, President Wilder, Pomona, White Imperial. *Gooseberries.*—Columbus, Triumph, Downing, Pale Red, Lancashire Ladd. *Blackberries.*—Snyder and Taylor. *Red raspberries.*—Cuthbert, King, London. *Black raspberries.*—Cromwell, Brackett Seedling, Eureka, Hilborn, Kansas, Lovett, Older, Souhegan. *Strawberries.*—Clyde, Brandywine, Boynton, Howard No. 36, Greenville, Glen Mary, and Parker Earle.

To test the keeping qualities of different varieties of apples, specimens grown in 1896 were gathered when in best condition for marketing

and placed in cold storage. The following varieties were in good condition July 1, 1897: Ben Davis, Delaware Winter, Ord Beni, Willow Twig, Whinnery Late, Langford, and Walbridge. Ben Davis, Delaware Winter, and Walbridge were still in good condition February 10, 1898.

A collection of some 350 seedlings of Shaffer raspberries fruited in 1897. The seedlings were grown from seeds taken from the best berries on a row of Shaffer raspberries standing between fields of Marlboro and Thompson Prolific. In regard to the seedlings the author says:

"More than half of the seedlings are of the red raspberry type (*Rubus strigosus*), the majority of the fruits, however, being purple in color like the parent or like that of the old variety Philadelphia, and nearly all were of good size and quality. Many of the plants produced large, well-formed berries of a bright scarlet color and of the best quality. Some show great promise. Among these seedlings were found almost every style of development between the nearly typical form of the blackcap (*Rubus occidentalis*) and that of the wild red raspberry (*R. strigosus*), and also a few albino or white or yellow forms of both species."

To determine whether heading in plum trees while dormant or while in the early stages of growth give best results, 10 trees, 2 each of 5 varieties, were selected and 1 tree of each variety was severely headed in March 30 and the second May 22. The trees pruned in winter made a vigorous growth of a few shoots while those pruned in summer made a fair growth of many shoots. The winter-pruned trees developed a fair quantity of fruit buds while the summer-pruned ones developed a large quantity of fruit buds.

Hardy apples for cold climates, F. A. WAUGH (*Vermont Sta. Bul. 61, pp. 19-32, figs. 6*).—The author discusses the northern progress of apple culture and considers that the factors in this progress have been the planting of crab apples and dwarf apples, the introduction of Russian varieties and especially the selection of native hardy seedlings, and the adoption of better orchard practices. The Russian apples are characterized, their favorable and unfavorable qualities contrasted, and a brief historical account of their introduction into the United States is given. The present status of apple culture in Vermont as regards hardiness of trees was investigated. A map of the State is given, showing the general limit of the successful culture of Baldwin and Rhode Island Greening apples. A number of varieties of apples are arranged according to their hardiness. To grow a given variety north of its natural limit it is recommended to top graft it on a hardy variety and to choose a protected situation with a favorable exposure.

Descriptive notes are given on a number of hardy varieties. For planting where hardiness is the principal consideration the bulletin recommends Yellow Transparent, Red Astrakan, Long Field, Oldenburg, Fameuse, McIntosh, Wealthy, Scott Winter, Pewaukee, and Arctic.

Some results following the application of wood ashes in the apple orchard, S. A. BEACH (*New York State Sta. Bul. 140, pp. 681-690*).—Experiments in the use of wood ashes in apple orchards were

carried on for 5 years. An old orchard which had previously been in sod was divided into 8 sections, to 4 of which ashes were applied annually at the rate of 100 pounds per tree. Tables are given comparing the yield and keeping qualities of apples grown on treated and untreated sections. The relative resistance of a number of varieties to apple scab is also tabulated. The author summarizes the work as follows:

"On the treated sections of the orchard the foliage in many cases was improved, but it can not be said that the improvement was due to increased immunity from the scab.

"When the ashes were used the color of the fruit was much improved in some seasons with some varieties, but in a season which favored the perfect development of the fruit none of the varieties showed any improvement in color as compared with the same varieties on untreated sections.

"Apparently the use of ashes had a general tendency to hasten the perfect development of the fruit. When the season was not especially favorable to the perfect development of the fruit it improved the keeping quality, but in a season very favorable to the perfect development of the fruit the ripening processes were generally carried so far, where the ashes were used, that the apples did not keep so well as where no ashes were used.

"The yield, except with the Baldwins, was greater on the treated sections; but the data are not such as to make it safe to draw definite conclusions as to the effect of the use of ashes on the yield.

"Decided differences were shown between varieties as to the ability to resist scab, and preliminary investigations indicate that this difference in resistant power is correlated with structural peculiarities."

Fourth report upon chrysanthemums, W. MILLER (*New York Cornell Sta. Bul. 147, pp. 657-689, figs. 12*).—The author discusses the economic status of the chrysanthemum, stating that chrysanthemum growing in New York probably involves more capital than peach growing. The chrysanthemum has come to be one of the four main florist's flowers. Suggestions are given on growing chrysanthemums at home. The method of procedure depends largely upon the type of plant desired. The use of crown and terminal buds in the production of exhibition flowers is discussed. The terms as used in chrysanthemum culture are distinguished as follows: "A crown bud is surrounded by vegetative shoots and not by other buds. A terminal bud (in chrysanthemums) is surrounded by other buds and not by vegetative shoots." With some varieties the foliage and form and color of the flowers are very noticeably affected by the choice of the terminal or crown buds. The chief merits of crown buds are earliness and large size. In all other respects terminal buds are likely to be superior. A number of references to the literature of the subject of crown and terminal buds are given.

The problem of control of color of chrysanthemums is discussed. In regard to the factors of the problem the author says:

"The choice of buds is said to be sufficient in some cases. Thus, J. H. Woodford is advertised as shell-pink from terminal and pure white from crown buds. Overpropagation is generally believed to weaken colors. Temperature and ventilation (the two factors can hardly be separated in greenhouse practice throughout the

entire year) are advertised to produce three distinct and desirable shades in Mrs. Col. Goodman. Mere position (in pots, beds, or benches) should not in itself make a difference, but in practice it does. The effect of shade is variously stated. And, most complicated of all, the food factor is known to influence color, but just how is a mystery."

Two of the factors were tested, namely, "whether shading the flower beds would make the flowers a lighter or darker pink, and whether a liberal supply of nitrogen would weaken or deepen the colors." In the shading test 24 plants were exposed to the sunlight at every stage of their growth, and 36 were shaded by means of a rather heavy coat of whitewash applied to the glass directly over them. The flowers of some varieties had begun to open before the whitewash was applied, while the flower buds of other varieties were about the size of marbles when shading was begun. The shading was continued until the flowering season was over. In the nitrogen experiment 23 plants were given the ordinary amount of nitrogen and 37 plants were given in addition a solution of nitrate of soda at intervals of from 3 to 4 days from the time the plants were well rooted until the flower buds began to form. As to the results the author says:

"Shade is said by some to deepen the color, but the reverse was true in this case. The difference was perceptible at once in 5 varieties (Mrs. Perrin, Madame Felix Perrin, Marie Valleau, Helen Bloodgood, and Iora) and at second glance in 2 others (William Simpson and Maud Dean). In only 2 cases, however, was this difference enough beyond question to destroy their salable character, but they are the most important varieties in the list. Mrs. Perrin and Madame Felix Perrin are among the most important midseason commercial sorts of the day. They are so much alike that only an expert can tell them apart. Their peculiar charm is their sparkling, bright rosy-pink color. The flowers of these 2 varieties, whose buds were shaded, were very uneven in color. The loss of color was the only loss, and it alone was enough to destroy their salable character. This can not be attributed to a general lack of vigor in the plants. The experiment shows clearly that during the reproductive phase the forming flowers are extremely sensitive to shading and are sometimes practically ruined by it. There was only one contradictory plant among 26 that were strictly comparable. . . .

"The results of the nitrogen experiment were not certain enough to be published, but it is safe to say that the extra amount of nitrogen did not seem to deepen the color in any case."

Notes are given on a test of a considerable number of varieties of chrysanthemums in 1897. The 10 varieties considered best of those tested are Midge, Geo. S. Kalb, Dr. C. H. Parkhurst, Wm. J. Bryan, Golden Trophy, Elvena, Wood's Pet, Leonidas, Loantika, Casco.

The kitchen garden (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 2, pp. 315–341, figs. 9*).—Popular directions for the culture of numerous garden vegetables, flowers, etc.

Celery, asparagus, and strawberries, R. M. SIMMERS (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 636–649, figs. 7*).—A popular article on the culture of celery, asparagus, and strawberries.

On chicory and variations in its composition, B. DYER (*Analyst, 23 (1898), Sept., pp. 226–229*).

The cultivation of American ginseng in Pennsylvania, G. C. BUTZ (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 617-635, figs. 4, pls. 2*).—A reprint of Bulletin 27 (E. S. R., 9, p. 1053).

The gilliflowers, VILMORIN-ANDRIEUX (*Belg. Hort. et Agr., 10 (1898), No. 18, pp. 277, 278; 19, pp. 294, 295, figs. 5*).—Descriptive notes and illustrations.

Mangoes in America, H. E. VAN DEMAN (*Florida Farmer and Fruit Grower, n. ser., 10 (1898), No. 43, pp. 677, 678*).—Notes on varieties, propagation, and introduction of mangoes.

The stoneless plum (*Amer. Gard., 19 (1898), No. 201, p. 743, fig. 1*).—A stoneless plum is described and figured and citations are given to two French works on fruits in which the same variety is described.

Nursery stock pests and their repression, F. H. HALL (*New York State Sta. Bul. 136, popular ed., pp. 10, pls. 4*).

Small fruits, A. T. JORDAN (*New Jersey Stas. Bul. 126, pp. 32*).—A reprint from the Annual Report of the station for 1897 (see p. 433).

On the progressive development of raisin grapes, A. GIRARD and L. LINDET (*Bul. Soc. Chim. Paris, 3. ser., 19 (1898), No. 13, pp. 585-588*).

Home-grown grapes in Vermont, F. A. WAUGH (*Vermont Sta. Bul. 62, pp. 35-44, figs. 10*).—The bulletin gives directions for the culture of grapes in Vermont and descriptions and illustrations of a number of varieties. As the result of tests the following varieties are recommended: Moor Early, Worden, Moyer, Brighton, Wyoming Red, and Green Mountain.

Viticulture in Beaujolais (*Une exploitation viticole en Beaujolais. Macon: Protat Frères, 1898, pp. 31, pls. 13*).

Pruning, A. DESPEISSIS (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 4, pp. 241-259, figs. 25*).—A popular article on pruning grapes.

The papaw, A. MORRISON (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 4, pp. 292-294, fig. 1*).

On the promotion of flowering and change of color in flowers, M. MIYOSHI (*Bot. Mag. [Tokyo], 12 (1898), pp. 35-43*).

The species of azalea, W. J. BEAN (*Garden, 54 (1898), No. 1403, pp. 282-284, figs. 2, pl. 1*).—Notes on the ornamental qualities and culture of several species of rhododendrons and azaleas.

A new species of catasetum, with remarks about the genus, O. AMES (*Amer. Gard., 19 (1898), No, 201, pp. 741, 742*).

The clematises, J. LEBELLE (*Garden, 53 (1898), No. 1388, pp. 544-548, figs. 4; 54 (1898), No. 1399, pp. 200, 201; No. 1401, pp. 240, 241*).—This is an extract from the twelfth volume of the *Bulletin de la Société d'Horticulture de Sarthe*, giving descriptions and classification of a large number of species and hybrids of clematis

Hybrid Wichuraiana roses, W. A. MANDA (*Amer. Florist, 14 (1898), No. 531, pp. 1, 2*).—Several hybrids of the hardy Asiatic rose (*Rosa wichuraiana*) with garden and forcing-house roses are noticed. Some of these combined in a remarkable way the characteristic foliage and hardiness of the Asiatic rose with other characters of the garden and forcing roses.

Hybrids of Rosa wichuraiana, H. DAUTHENAY (*Rev. Hort., 70 (1898), No. 20, pp. 479, 480*).—Notes on results obtained by American gardeners.

Shrubs for the seaside and their grouping, M. HOWATH and M. MUNTE (*Amer. Gard., 19 (1898), No. 194, pp. 635-637, figs. 2*).—These are prize articles on shrubs for exposed locations near the sea. Diagrams give the arrangement of groups suggested.

New Hampshire fruit calendar for 1897, F. W. RANE (*New Hampshire Sta. Bul. 48, pp. 130-138, figs. 4*).—This is a report on the condition of various orchard and small fruits in 1897. The fruits of several varieties of apples, pears, and plums are figured.

Report of the horticultural department of the Royal Academy experiment station, 1897, ERIK LINDGREN (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 3, pp. 133-147*).

FORESTRY.

The bald cypress, F. ROTH (*U. S. Dept. Agr., Division of Forestry Circ. 19, pp. 24, fig. 1*).—The author presents in a condensed form the results of tests and investigations made on the physical and mechanical properties of the bald cypress, *Taxodium distichum*, one of the important timber trees of the Southern States.

The bald cypress, a name given this tree on account of the fact that it loses its foliage in winter, includes white, yellow, black, and red cypress, names which have been used for advertising or other purposes, and which have caused much confusion as to actual differences in the timber.

Notes are given on the range and manner of occurrence, character of growth, and age of trees. More than 90 per cent of the cypress occurs on elevations of less than 100 ft. above sea level, and large bodies of merchantable cypress are not known to occur at elevations above 500 ft. The present supply of cypress is estimated at 27,000,000,000 ft., board measure, distributed among the States of Louisiana, Florida, Alabama, South Carolina, Georgia, North Carolina, Arkansas, and Mississippi. The estimated annual cut is about 500,000,000 ft. the greater part of which is taken within 120 miles of New Orleans.

The method of cutting generally pursued is to girdle the trees the season prior to felling them. This appears to be of doubtful value, since it adds but little to the floating capacity of the logs and endangers the timber. If girdling is done in the spring or summer, or even in early fall, insects at once begin their work. Generally their attack is confined to the inner bark and surface of the wood, but in some cases a large borer of the Ambrosia beetle group bores straight into the wood and produces a sharply marked black stain.

Notes are given on the character of the wood and its physical and mechanical properties.

There is a disease of the cypress known as "pegginess," said to be due to a fungus. This disease usually begins at the broken stub of a limb and works downward. A cross section of an infected log looks as though a number of small pegs $\frac{1}{4}$ to 1 in. in diameter had been driven into the wood and then withdrawn, the holes being filled with powdery decayed wood. Young trees are generally free from this trouble, and in no case was it seen in trees except where part of the crown had been broken off. The total loss due to this cause is probably not less than 30 per cent of the entire cypress supply. No region or locality seems to be entirely free from this defect, although places exist here and there that are especially infested. It is usually impossible to tell diseased from sound trees prior to felling them, but the common belief that the disease spreads after the timber is converted into lumber is not founded on fact.

In conclusion the author states that "the supply of cypress is considerable and the output capable of considerable increase, but once gone the present forests will be unable to replace the supply, and it is doubtful whether cypress can be considered as a timber of the future."

Increasing the durability of timber, B. E. Fernow (*U. S. Dept. Agr., Division of Forestry Circ. 20, pp. 5*).—Popular information is given as to the cause and conditions of decay of wood. The manner in which timber is used and the actual factors influencing durability are pointed out. Lists of the more durable and less durable trees are given for the different parts of the country. The more durable trees of the eastern range are the red and white cedars; arborvitæ; bald cypress; tamarack; long leaf, Cuban, loblolly, short leaf, pitch, white, red, and jack pines; hemlock; spruce; live oak; white oaks, including white, post, bur, cow, and overcup; osage orange; red mulberry; black locust; catalpa; black walnut; chestnut; sweet (red) gum, and tulip. The less durable trees of this region are the elm, ash, red oak, and basswood. Trees not durable are hickory, maple, beech, blue beech, and birch.

The more durable trees of the Rocky Mountain region are the red cedar, piñon, foxtail pine, Douglas spruce, and western larch.

On the Pacific slope the more durable trees are the yew, redwood, Pacific arborvitæ, yellow cedar, Port Orford cedar, cañon live oak, and Pacific post oak.

The time of felling as influencing the durability of wood is mentioned, and treatment of timber after felling is considered at some length. The use of coatings to keep out moisture and preserve wood is discussed and the advantages of different preparations pointed out.

Forestry experiments at the Mustiala experiment station, 1894–95, T. Cannelin (*Land. Styr., Meddel., 1897, No. 20, pp. 58–72.*)—The influence of forests on the temperature of the ground was studied, soil temperatures being taken daily in 3 different places, in a (1) 140-year-old pine forest, moist and sandy ground, (2) a small opening, 300 meters from the preceding place, and (3) a grove of birch, spruce, and pine, the ground drier than the other 2 places, and removed about 300 meters from the second. The temperature was taken at depths of 2, 1, and 0.5 meters in case of 2 and 3, and at 2 and 0.5 meters in case of 1. The summary figures for the different months of the year are given below.

Summary of soil temperatures at different depths.

Month.	Pine forest.		Opening.			Birch grove.		
	2 meters.	0.5 meter.	2 meters.	1 meter.	0.5 meter.	2 meters.	1 meter.	0.5 meter.
	Deg. C.	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*
January	3.70	.98	3.19	2.29	1.52	3.94	2.25	0.87
February	3.01	.40	2.64	1.82	1.12	3.08	1.62	—.43
March	2.24	.18	2.15	1.43	1.00	2.96	1.01	—.37
April	2.43	.38	1.80	1.30	1.00	2.35	.90	.22
May	2.00	.56	2.40	3.38	4.83	2.20	1.35	1.47
June	3.01	6.00	5.15	8.00	4.10	4.07	5.20	7.41
July	5.60	9.90	7.70	10.80	13.90	6.19	8.40	10.40
August	4.03	10.30	8.95	13.01	11.40	7.50	9.40	11.05
September	7.51	8.38	8.80	9.70	9.89	7.98	8.40	5.54
October	7.10	6.40	7.60	7.63	6.93	7.60	7.00	6.61
November	5.86	3.07	5.71	4.75	3.68	6.29	4.27	2.81
December	3.97	1.52	.38	3.09	1.90	5.12	2.80	1.50
Average for the year	4.20	4.00	4.70	5.60	5.69	4.43	4.38	3.92

—F. W. WOLL.

Studies in forestry, L. Petrini (*Atti R. Accad. Econ. Agr. Georg. Firenze, 4. ser., 20 (1897), No. 3–4, pp. 275–306*).

Technical and economic studies in forest culture, L. Galloni (*Atti R. Accad. Econ. Agr. Georg. Firenze, 4. ser., 20 (1897), No. 3–4, pp. 307–402*).

Some notes on the life history of forest trees, A. Heimerl (*Wiener Illus. Gart. Ztg., 1898, No. 3, pp. 95–110, figs. 2*).

On forest culture, M. A. Grude (*Om Skookultur. Christiania, Norway, 1898, pp. 240*).

Tree planting on public streets, C. M. Loring (*Amer. Florist, 14 (1898), No. 532, p. 48*).—Suggests trees adapted to the purpose.

Tree planting in desert wastes (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 3, p. 213*).—The author recommends the planting of *Acacia arabica* in the desert portions of Australia. The economic uses to which the tree is put are mentioned.

Our woods and forests, A. C. Forbes (*Gard. Chron., 3. ser., 24 (1898), No. 610, pp. 176, 177; 612, p. 213*).—Notes are given on some of the more interesting facts concerning the Crown woodlands of Great Britain.

The plane tree (*Gard. Chron., 3. ser., 24 (1898), No. 611, p. 190*).—Notes are given on *Platanus orientalis* and its value as a decorative tree. Several varieties of this species are briefly described and their relative merits given.

Report of the Commissioner of Forestry, J. T. Rothrock (*Pennsylvania Dept. Agr. Bul. 34, pp. 91–107*).—The author describes the present forest conditions of the State and the relation between rainfall, water flow, and forests. Figures are given showing the diminished flow during the autumn months of the Schuylkill River at Philadelphia, in which it appears that between 1816 and 1895 there was a depreciation of more than 60 per cent in the water flow of the stream.

Forest protection against tidal waves, S. Honda (*Col. Agr. [Tokyo], Bul. 3 (1898), No. 4, pp. 281–298, pls. 2*).—An account is given of the value of forests as a means of protection against tidal waves or floods.

Practical assistance to farmers, lumbermen, and others in handling forest lands, G. Pinchot (*U. S. Dept. Agr., Division of Forestry Circ. 21, pp. 5*).—This circular shows some of the practical results of proper handling of forests and states the conditions on which the Government will cooperate with forest owners. Tracts of any size from 5 acres up are eligible, the only distinction made being that the owners of large tracts which may present more difficult questions will be required to share in the expense of solving them, while owners of small tracts will receive assistance without expense. Two forms of agreement are given and applications can be made at any time.

DISEASES OF PLANTS.

Report of the botanist, B. D. Halsted (*New Jersey Stas. Rpt. 1897, pp. 263–341, 355–394, figs. 45*).—The chief lines of work reported upon are with fungicides on various vegetables and ornamental plants, prevention of the sweet-potato soil rot, pear fire blight, peach-root gall, and the diseases of violets. The work with weeds has been continued and an experiment made to ascertain their influence on crop and soil.

Experiments with turnips (pp. 265–274).—The author has continued the investigations on club root (E. S. R., 9, p. 654). In the experiments in 1897 soil treatments of lime, sulphur, corrosive sublimate, kainit, copper sulphate, and Bordeaux mixture were given, but of these only the lime treatment gave satisfactory results, and this has proved almost

a specific for the prevention of club root. A second crop of turnips was sown on the ground after the removal of the first and the lime in this case gave much better results than in the first crop. The susceptibility of different varieties of turnips to club root was investigated to some extent. Other things being equal, the variety which is most superficial in its growth in the soil may be the least susceptible to club root. A limited experiment with buckwheat on turnip land was thought to indicate that buckwheat would exert a wholesome influence on a soil that is "turnip sick" from the presence of the club-root fungus. The effect of shading on the development of the club-root fungus was tested, and it was found that the growth of the fungus was as active in shaded as in exposed soils. Experiments were also conducted with 34 varieties of crucifers and 21 other plants representing 12 different genera, and it was found that while there is a large group of wild and cultivated crucifers that are susceptible to club root, many others are only occasionally attacked and may be grown on badly infected soil without being seriously injured. Of the plants representing other genera than crucifers no indication of club root was detected in any species.

Experiments with cabbages (pp. 275, 276).—Cabbages were sown on soil which had become so badly infected with club-root fungus that turnips in 1896 were almost all diseased. The cabbage seed was sown in a portion of this infected soil and at the time of setting out check plants that had been started in limed soil were planted for comparison. The details of the experiments are given, showing that the probable time when the plants are most susceptible is when they are quite small, and if this period can be passed free from exposure to the germs of the disease the crop may be almost sure.

Experiments with potatoes (pp. 276–284).—For the past 4 years one portion of the experiment station area has been devoted to the growth of potatoes to investigate the means for the prevention of potato scab (E. S. R., 9, p. 57). In 1897 the experiments of the previous years were modified somewhat. Oxalic acid, Bordeaux mixture, sulphur, kainit, sulphuric acid, and corrosive sublimate were employed as fungicides, and the effect of growing large-rooted weeds and sweet potatoes on the development of the disease was tested. The yields of the different plats are given, and so far as checking scab is concerned sulphur was the most efficient. The season was particularly adapted to the development of the potato rot due to *Phytophthora infestans*. The worst specimens of this disease were found on the shaded portion of the plat, although the plants in this area were somewhat later in being attacked.

Experiments with peppers (pp. 284, 285).—In continuation of previous experiments with peppers, 9 varieties were tested during 1897; and while disease was almost entirely absent throughout the season the experiment seems to indicate that in general pepper plants are too little infested with fungi to warrant the application of fungicides.

Experiments with tomatoes (pp. 286–291).—In 1897, 7 varieties of tomatoes were sprayed with Bordeaux mixture, soda-Bordeaux, potash-Bordeaux, and hydrate, the idea being to test the fungicides for the prevention of the various diseases to which this plant is subject. The only disease observed to affect the foliage of tomato plants was *Septoria lycopersici*, while a few fruits were attacked by *Glœosporium phomoides*. The plants which had received Bordeaux mixture were practically free from disease. The yield of fruit is tabulated, from which it appears that there was a marked falling off in the amount of fruits produced by the plants sprayed with soda-Bordeaux and hydrate. Both fungicides burned the foliage somewhat, but it was not thought sufficient to do serious harm. The least productive portion of the plat was that which was shaded; while, on the other hand, the shaded rows suffered very little from the blight.

Experiments with Lima beans (pp. 292–299).—Experiments conducted with dwarf Lima beans showed there was very little blight in any part of the plat, and no conclusions could be drawn from the experiments. The origin of the dwarf Limas and their description are given. Brief notes are appended on the mildew of Lima beans, in which it is stated that the mildew was worst on plants growing upon rich low land where the same crop had been grown the previous year. It would seem best for Lima beans to be planted on high ground, as early as possible, and they should not immediately follow a similar crop.

Experiments with onions (pp. 300–302).—The author reports the occurrence during 1897 of the smut fungus of onions (*Urocystis cepulæ*). From observations made in the field it would seem that there are marked differences in the susceptibility of varieties to this disease, the tender white sorts being more inclined to the disease than the yellow ones. Experiments conducted with onions in new fields, the plants having been sprayed 6 times, showed that there was very little smut anywhere, even the check rows being free from the disease. An experiment in preventing infection through the seed was made with seed soaked in hot water (135° F.) for 15 minutes, soaked in corrosive sublimate, or rolled in sulphur, and in adding corrosive sublimate and sulphur to the soil. The plants came up fairly well in all boxes except where the seed was treated with hot water, in which case there was a complete failure. There was no smut in any instance; the experiment, therefore, was without result.

Results with spinach (pp. 302, 303).—Experiments were conducted with a number of varieties of spinach for the prevention of an undetermined disease which causes a loss of the green color and the final dwarfing of the young plants. The plants grown in the shade were larger and remained green longer than those exposed to the sun, and it is probable this crop can be grown throughout the season with profit where some protection, as partial shade, is provided. Notes are given on the occurrence of a Cercospora on the leaves of spinach,

closely resembling that occurring on beet leaves. There appears to be some difference in the characteristics of the two, but the variations are thought to be within the limits of a species, and their probable identity is pointed out.

Experiments with eggplants (pp. 304–307).—Four varieties of eggplants were sprayed with different fungicides for the prevention of attacks of *Phyllosticta hortorum.* There was but little difference noted in the effectiveness of the 4 fungicides used. An examination of many of the roots at harvest time showed they were badly infested with nematodes, in some places the galls being very apparent.

Experiments with lettuce (pp. 307–309).—Sprayings were made with 4 fungicides on different varieties of lettuce, for the prevention of blight, and it was found that the early sprayings of all the plants somewhat injured them. There was very little blight present until the plants had passed blooming. On this account there was no estimate made of the amount of damage or of the efficiency of the fungicides.

Experiments with beans (pp. 309–314).—Experiments were conducted during 1897 with beans on soil that had grown 7 or 8 successive crops, the object being to test means for the prevention of pod spot and bacterial blight, both of which have existed to some extent since 1894. No appreciable amount of blight was present and in many cases the application of the fungicides to the young plants had an injurious effect. A second crop was planted July 31 and treated with fungicides the same as before. There was no marked difference in the action of the different fungicides, but the potash-Bordeaux mixture was slightly better than the others. The effect of thinning pods as a means of preventing disease was investigated and found to be without any appreciable value.

Crimson clover disease (pp. 314–319).—Notes are given of a crown disease of crimson clover, due to *Sclerotinia trifoliorum.* Desiring to study the fungus in the field, a plat was sowed with different kinds of clover and allied plants, the ground being strewn with the debris of dead plants and adhering soil after the seed was sown. Of all the clovers tested, the crimson clover proved most susceptible to the disease. The author states that there is nothing to indicate that the disease may be transmitted by seed, but that a field once badly infected should be plowed and planted to other crops for a number of years. The occurrence of another fungus, *Polythrincium trifolii*, on scarlet clover, is mentioned.

Experiments with cucumbers (pp. 319–322).—Eight applications of 4 different kinds of fungicides were made on a number of varieties of cucumbers, to test their efficiency in preventing mildew and anthracnose. The anthracnose was not noticed on any of the plants during the year. The other disease became quite abundant in September, the plants sprayed with Bordeaux mixture and potash-Bordeaux being less affected than the others. An attempt was made to inoculate cucumbers with an anthracnose of hops due to *Colletotrichum* sp., without success.

Experiments with peas (pp. 322–324).—In continuation of the experiments reported in 1896 (E. S. R., 9, p. 656), applications to the soil of sulphur, corrosive sublimate, carbonate of lime, and copper sulphate were tested for the prevention of blight and mildew of this plant. The largest yield was obtained where the soil was treated with corrosive sublimate and carbonate of lime. On a second crop, 4 fungicides were tested with somewhat inconclusive results.

Experiments with carrots (pp. 325, 326).—Six varieties of carrots were tested to ascertain their relative resistance to blight. No spraying was given the plants and no estimate was made to determine the relative market value of the different sorts. Of the 6 varieties tested the Danvers Half Long proved the most resistant.

Experiments with celery (p. 327).—The carrots mentioned in the previous paragraph were followed by celery, the desire being to ascertain whether these allied plants would be subject to the same diseases. The celery was sprayed with different fungicides, in all 7 applications being given, but the plants being remarkably free from celery blight the relative value of the fungicides was not determined.

Experiments with beets (pp. 327–334).—Experiments have been continued for a number of seasons for the control by the use of fungicides of beet-leaf spot (*Cercospora beticola*). The seed was sown April 19 and the plants were sprayed when little more than the first leaves were developed, in all 10 applications being given during the season. The leaf spot was first noted the last week in June and in the check plats it increased rapidly. Where the hydrate solution was used the disease developed somewhat slower than in the checks, but plants sprayed with this fungicide suffered much more severely than those which received the different Bordeaux solutions. The different kinds of Bordeaux mixture showed no marked differences. In the experiments with the second crop of beets, all the fungicides except Bordeaux mixture burned the foliage of the young plants to some extent, but as in the previous year's test no Cercospora appeared. The effect of weed growth on beet production was tested. In this experiment 8 oz. of 30 different kinds of weed seeds were sown over a plat of beets 138 ft. long and 11 ft. wide. Different portions of the plat were subjected to different treatments, one receiving no cultural attention while the others received 3, 5, and 7 hoeings, respectively. The yield of beets was almost in proportion to the amount of attention given the plats. Concerning the growth of the weeds it is said that in some cases the ground was so thoroughly covered by them that many of the weeds were wilted and crowded out.

Experiments with ornamental plants (pp. 334–339).—Fungicides were tested for the prevention of diseases of the following plants: Violets, China asters, pinks, nasturtiums, mignonette, phlox, sweet peas, gladiolus, cannas, dahlias, ampelopsis, hibiscus, hollyhocks, red bud, and peony. In the case of the China asters the principal trouble is a rust due to *Coleosporium* sp. The disease did not appear to any great extent

but the plants were injured by insects so that their growth was seriously interfered with, therefore no report could be made of the value of the spraying. The fungicides seemed to have no effect on nasturtium blight, and scarcely adhered at all to the leaves. The experiment with sweet peas tested not only the effect of fungicides but also the effect of different depths of planting. The largest number of flowers were obtained where the seeds were planted 3 in. deep and hilled up 2 in. Where seeds were first soaked in Bordeaux mixture, rolled in sulphur and corrosive sublimate, and planted 2 in. deep, all gave good results. The canna plants were free from fungus diseases, but the foliage of some plants was injured by the application of soda-Bordeaux and hydrate. The mildew of dahlias appeared abundantly on unsprayed sections during the autumn but it was easily checked by the use of fungicides. Hollyhocks sprayed with different Bordeaux mixtures, receiving in all 13 sprayings, were almost entirely free from the leaf spot which appeared on the check plats early in the season and continued until its close. The hollyhock rust (*Puccinia malvacearum*) was found almost without exception on check plants, while but one sprayed section showed any disease. The sprayed peony plants bloomed much less abundantly than the unsprayed plants and no disease was observed on any.

Experiments with fungicides (pp. 330–344).—The author gives the formulas and methods of preparation of the fungicides used in the preceding experiments, namely, Bordeaux mixture, soda-Bordeaux, potash-Bordeaux, and cupric hydrate.

Experiments in infecting soil with potato-scab fungus (pp. 355–359).—Experiments are reported in which scabby potatoes were (1) spaded into the soil; (2) steamed 20 minutes and then spaded in; (3) applied to the surface of the soil and allowed to remain over winter, and (4) fed to stock and the manure applied to the soil. The results are tabulated and the following conclusions drawn:

Scab was greatest where the untreated potatoes were spaded in in September, followed closely by the case in which steamed potatoes were spaded in. The plats which received manure gave results which indicated a very limited presence of the scab fungus. While the experiment was somewhat limited, it was interesting to notice the almost entire absence of scab where the infested potatoes were fed to cattle and the manure placed on the land. This seems to indicate that there is little danger in disposing of scabby potatoes in this manner.

An additional experiment is reported in which a number of solanaceous plants, together with a miscellaneous lot, were tested to ascertain their susceptibility to the scab fungus. Of the solanaceous plants, only the roots of tomato, pepper, tobacco, and *Datura stramonium* showed any evidence of the fungus. Sweet potatoes gave no indications of the disease. Artichokes, cardoon, chicory, salsify, parsnips, and 6 varieties of radishes were tested, and while all the varieties of radish were more or less disfigured by scab, the other plants remained free.

The influence of drought on vegetation (pp. 360–362).—The year 1897 is said to have been remarkable for excessive rains in July and for 3 periods of drought during the growing season, the influence of which on vegetables and ornamental plants is stated.

Experiments with sweet potatoes (pp. 362–372).—In continuation of work reported on sweet-potato diseases (E. S. R., 9, p. 655), the effects of sulphur and kainit were again tested, different plats receiving 800, 600, 400, 300, and 200 lbs. of the fertilizer. Two varieties of sweet potatoes were used, Nansemond and Jersey Red. The results indicate that sulphur is valuable as a remedy for the prevention of the soil rot, and that it may be advantageously used in connection with kainit.

Experiments in spraying for asparagus rust (pp. 372–376).—The extensive experiments with fungicides showed that while they did not prevent the disease they reduced it fully one-fourth.

Experiments with pear blight (pp. 377–383).—The author reports upon a series of experiments begun on an orchard placed at the disposal of the station, the present report being confined to the effect of winter and summer pruning. In general it may be stated that while the winter-pruned trees were cut back the heaviest the pears were much larger and yielded about as great a quantity as the summer-pruned ones, the difference between the 2 forms being very slight. The experiments testing the effect of cultivation and the use of fertilizers on the development of blight are to be continued.

Greenhouse experiments with violets (pp. 383–394).—The leading fungus diseases of the violet are said to be the leaf spots (*Cercospora violæ*), a second form of leaf spot (*Phyllosticta violæ*), *Ascochyta violæ*, *Marsonia violæ*, *Glæosporium violæ*, an anthracnose due to an undescribed Colletotrichum, a mildew (*Peronospora violæ*), and *Zygodesmus albidus*. In addition to these nematodes are one of the most serious troubles of violets. During the winter of 1896–97, experiments were conducted in the greenhouse in which the effect of depth of soil, fineness of mixture, drainage, mulching, watering, subirrigation, fertilizers, manure, aeration, spraying, and soil fungicides were tested. A depth of soil of 5 in. seemed to give best results. The coarsest soil, i. e., that which did not go through a sieve with a half-inch mesh, gave best results. Where sand was added in different quantities to fine soil but little difference was noted. The experiment in soil drainage seemed to indicate that the use of rock bottom for drainage is useless. Increasing the amount of manure was followed by beneficial results. There was no leaf spot or other foliage disease which seemed to interfere with the growth of the plants, but attacks of nematodes were very apparent, many of the plants being badly galled.

Field experiments were conducted with violets in which soil treatment with lime, sulphur, corrosive sublimate, and kainit were tested, the intention being to note the results of this soil treatment on the winter plants. All the treatments greatly reduced the formation of nematode galls on the roots, and in many cases wholly prevented them.

Some important pear diseases, B. M. Duggar (*New York Cornell Sta. Bul. 145, pp. 596–627, figs. 16, dgm. 1*).—Notes are given on pear-leaf spot, leaf blight, pear scab, and pear blight.

The leaf spot due to *Septoria piricola* is said to be widely distributed throughout the State, and while the fungus is one of the most important from an economic standpoint, it seems to have been almost wholly overlooked or neglected. Perhaps one of the earliest mentions of this disease was that by G. F. Atkinson.[1] It is usually confused with the ordinary leaf blight, due to *Entomosporium maculatum*. The leaf spot, as it appears on the green leaves, is usually larger, more sharply defined, and somewhat angular, being roughly limited by the subdivisions of the venation. The center of the spots is grayish-white, dotted with minute pycnidia. Surrounding this is a brown zone, which frequently shades off into a purplish color. The cluster of fruiting bodies in the center of the spot is a very evident characteristic.

The author reports the disease as probably occurring all over the State of New York wherever pears are raised, and also in Pennsylvania, Maryland, Virginia, Alabama, and elsewhere. His investigations seem to indicate that different varieties are subject to the disease in varying degree. Anjou, Seckel, Bosc, Summer Doyenne, and Bartlett are quite subject; Louise Bonne, Clairgeau, Clapp Favorite, Flemish Beauty, and others to a less extent; Duchess very slightly, and Kieffer and Winter Nellis are apparently free from it.

An experiment was conducted in which Bordeaux mixture, ammoniacal copper carbonate, and potassium sulphid solution were sprayed on Bartlett and Seckel trees for the prevention of leaf spots. Three sprayings of Bordeaux mixture gave almost complete protection against the disease. The occurrence of leaf spot on nursery stock has also been investigated, and some attempts have been made to prevent injury. In this case, as in the trial in the orchard, Bordeaux mixture gave the best results. The microscopic characters of the fungus are given at some length. The author states that the fungus is evidently to be referred to *Septoria piricola*. He has compared American specimens with specimens from Europe and found that they agree in almost every particular.

The leaf blight of pears has also been studied in connection with the leaf spot, and the author states that the spots of the leaf blight are usually smaller than those of the leaf spot, are more nearly circular, and not so clearly defined on the under surface. On the fruit the spots of leaf blight are red at first, but soon become darker. The drying of the epidermal cells may cause cracking to a considerable extent, as in the case of the pear scab. The leaf-spot fungus in no case attacks the fruit. The microscopic characters, distribution, and remedies of leaf blight are given.

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[1] Garden and Forest, 10 (1897), p. 373.

The pear scab (*Fusicladium pirinum*) is figured and described at some length. The author states that his investigations on the pear fruit have shown that the principal stroma of the fungus is undoubtedly subepidermal. The fungus is said to pass the winter in the bark of twigs, producing in the spring a crop of spores to infect the young branches, leaves, and fruit. A winter stage of the fungus is reported from Germany as belonging to the genus Venturia. The possible identity of the pear and apple scab is briefly considered, but most of the recent work is said to show that the two fungi are specifically different. As is the case with other pear diseases, there is considerable difference in the susceptibility of the different varieties. Three applications of Bordeaux mixture, the first made just before blossoming, the second immediately after the petals have fallen, and the third about 2 weeks later, are generally sufficient to prevent attacks of this fungus.

The pear blight or fire blight, which is due to *Bacillus amylovorus*, is figured and described at considerable length, the conclusions of the author agreeing with those expressed by B. M. Waite (E. S. R., 8, p. 796).

Under each of the diseases described the author gives a brief bibliography.

Studies on bean anthracnose, E. GAIN (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 3, pp. 200–204*).—The author has made a study of the anthracnose of beans due to the fungus *Colletotrichum lindemuthianum*, paying particular attention to the effect the fungus produces upon the seed. He reports that anthracnosed seeds are less dense than sound ones, the difference amounting with one variety to from 3.4 to 4.8 per cent and in others as much as 8 per cent. The germinative ability of diseased seed was also studied, and it was found in a series of experiments that 10 per cent of the seeds did not germinate, while only 46 per cent made viable plants, the sound seed producing 98 per cent.

Experiments were conducted in the laboratory and in the field to test the propagation of the disease by seed and other means, and it was found that it spread quite easily from diseased seed, the presence of spores placed on a seed or in the soil.

The conclusions, briefly summarized, show that diseased seeds are easily recognized by their lessened specific gravity and lower germinating power. Plants from diseased seed are less resistent to subsequent attacks and seldom develop equal to those from sound seed. The distribution of the disease is easily effected through the soil or seed. The author recommends that seed be carefuly hand-selected before planting and the lighter seed thrown out.

A cure for the lily disease, H. BYATT (*Gard. Chron., 3. ser., 24 (1898), No. 603, p. 42*).—The author gives an account of his attempts to prevent the occurrence of this disease on *Lilium candidum*. The method of treatment, which he claims has proved successful, consists in removing the bulbs from the ground and, after they had dried, sprinkling

them well with flowers of sulphur and putting them in large paper bags. They are then well shaken until the sulphur has worked into the bulbs thoroughly, and while still covered with the powder are planted. This treatment was first tried in 1896, and the crop produced showed a marked improvement in the flowers, the plants seeming to be entirely free from disease.

Septoria graminum, a parasite of wheat, L. MANGIN (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 20, pp. 1438–1440*).—The author calls attention to the parasitism of this fungus, it being sometimes considered a saprophyte, and shows that under certain conditions of weather it undoubtedly becomes parasitic on the leaves of winter wheat. He states that a mild and rainy winter favors the extension of the parasite, and reports having found it abundant on the leaves in February, the pycnidia carrying spores in an advanced state of germination. Reports are given of inoculation experiments made in February, March, and April, in which the spores were placed on the leaves and the leaves kept damp either by means of contact with filter paper or under bell jars. In about seven days all the leaves which had been treated began to turn yellow, and a week later their tips became blanched and in the dead tissues the characteristic pycnidia of the fungus made its appearance. The author considers the parasitism of *Septoria graminum* established, and states that the damage done by the fungus can be easily seen in fields of winter wheat in the spring, the diseased leaves being smaller and of a different color than normal.

Wood ashes and apple scab, S. A. BEACH (*New York State Sta. Bul. 140, pp. 665–680*).—The author reports an experiment continued for 5 years in which liberal applications of hard-wood ashes were given 124 trees to test the effect of such treatment on the prevalence of apple scab, the theory being that the application of the ashes would induce a much more vigorous growth of the tree and so render it resistant to disease. The treated sections of the orchard showed in many cases an improved appearance of foliage, but there was no evidence of an increase in immunity from the disease. The author concludes that under the conditions of the investigation a liberal application of hard-wood ashes to the soil does not increase the immunity of apples from apple scab.

The communicability of potato-stem blight, F. C. STEWART (*New York State Sta. Bul. 138, pp. 632–631*).—The author conducted experiments to ascertain if possible the communicability of the potato-stem blight described by him (E. S. R., 8, p. 235). So far as his investigations go, the disease is not due to bacteria or fungi, but appears in all probability to be due to some impairment of the physiological functions of the plant. The results of the experiments give strong evidence that the disease is not communicable. Although they show that a fair yield of healthy tubers may be obtained from diseased seed, the planting of such seed is not recommended.

Attempts were made to inoculate the disease upon other closely related plants but without success.

The effect of plowing under green rye to prevent potato scab, F. C. STEWART (*New York State Sta. Bul. 138, pp. 629–631*).—The widespread notion that potatoes will be free from scab if grown on soil on which green rye has been plowed under just before planting was investigated by the author. The land used for the experiment was fairly uniform and in 1896 had grown a crop of potatoes which was so scabby that a large part of the crop was unmerchantable. Rye was sown on 3 alternating plats October 12 and was plowed under April 26, being at that time about 6 in. high. The plats were planted April 28 and half of all the seed tubers were soaked in corrosive sublimate before planting. The yield of the various plats is tabulated, and it appears that the total yield as well as the proportion of those free from scab was less on the plats where green rye had been turned under than on the others, while the unmerchantable tubers were considerably in excess on these plats. The conclusion drawn from this experiment is that the practice of plowing under green rye to prevent potato scab is not to be recommended, inasmuch as it tends to increase rather than diminish the amount of scab and may also reduce the yield. The large amount of scab on all the plats showed the uselessness of treating seed with fungicides when they are to be planted in soil known to be scab-infested.

Department of bacteriology, H. H. LAMSON (*New Hampshire Sta. Bul. 48, pp. 146, 147*).—A report is given of work carried on during the year, partly in continuation of work previously reported (E. S. R., 9, p. 763). Brief notes are given on leaf spot of apples, orange rust of quinces, and black knot of plums and cherries. For the leaf spot, due to *Phyllosticta pirini*, applications of Bordeaux mixture seem to have had but little effect. The orange rust of quince trees was also but little affected by the treatment, and the results of experiments conducted with Bordeaux mixture for the prevention of black knot will not be apparent until the season succeeding the application of the fungicide.

A brief report is made on the use of Ceres-pulver for the prevention of smut of oats and barley. But little smut occurred in any of the grain, but the author thinks there was slightly less where the seed was treated than in the other lots.

Experiments with potato scab in which the effects of different fertilizers were tested were continued, as well as experiments for the prevention of early and late blight.

An experiment was undertaken with Nitragin, but the culture was too old when used and the trial was made on so small a scale that no conclusions can be drawn.

Effects of common salt on the growth of carnations and carnation rust, F. C. STEWART (*New York State Sta. Bul. 138, pp. 631–636*).—Some florists having advocated the use of a solution of salt in the form of a fine spray on the foliage of carnations, believing that it prevented the attacks of rust (*Uromyces caryophyllinus*) and also gave the plants more vigor, the author conducted a series of experiments with 50 rooted cuttings which were potted in 6 in. pots, sunk in soil

out of doors. They were divided into different lots and treated at intervals of 2 weeks with different quantities of a $2\frac{1}{2}$ per cent salt solution, the different lots receiving during the investigation 10, 40, 80, and 200 cc. of a salt solution. In 1897 this experiment was repeated, the dates of application of the salt solution being May 18, 28, June 11, 25, July 9, 23, August 7, 20, and September 3. Both the experiments show that it was useless to try to prevent the rust by the use of salt solutions, either applied to the soil or on the foliage, and that such applications of salt did not aid in the growth of carnations.

Further experiments on spraying cucumbers, F. C. STEWART (*New York State Sta. Bul. 138, pp. 636–644*).—Experiments reported on the effect of spraying late cucumbers (E. S. R., 9, p. 248) were continued with early cucumbers. Eight rows of 25 hills each were planted early in May, and 4 of the 8 rows were kept well covered with Bordeaux mixture throughout the season, 14 applications being given the plants. The weather was rather unfavorable for the growth of cucumbers, yet they did fairly well. The first disease to make its appearance was the bacterial wilt disease, which appeared about August 2, and during the following 2 weeks killed about 50 plants on the unsprayed plat and only 5 or 6 on the sprayed. On August 11 there were traces of anthracnose on the unsprayed plat, and toward the end of the season it was very destructive It also did some damage on the sprayed plat toward the close of the season. The downy mildew appeared about the same time on the unsprayed plat, where it spread rapidly and did much damage, but did not attack plants on the sprayed plat. A careful record was made of the number and weight of the fruits of the different plats and the increase in number of fruits and weights due to the spraying as shown. In general it is stated that on Long Island it is unnecessary to begin spraying cucumbers until the middle of July. The downy mildew is easier to control by spraying than the anthracnose. The prevalence and destructiveness of the downy mildew of the cucumber on Long Island during 1896 is noted, and it is shown that it was more destructive that year than the year following. A relation between the appearance of this disease and the rainfall has been claimed, but the author states that probably the high temperature the first year had more effect than the rainfall.

For the purpose of ascertaining to what extent the downy mildew can be controlled when an entire field of cucumbers is sprayed, a cooperative experiment was conducted in which an acre planted to cucumbers was sprayed 8 times with Bordeaux mixture 1 to 8 formula. The dates of spraying were July 22, 30, August 7, 16, 25, September 4, 13, 20. The experiment was terminated by a killing frost on the night of September 28. The total yield of fruits is given, showing that the production was slightly in excess of 100,000 for an acre, the average yield on Long Island in 1897 being about 20,000 per acre.

The common observation that downy mildew is less destructive to cucumber plants when partly shaded led to an experiment in which

sweet corn was alternately planted with rows of cucumbers. The unshaded plants made considerably better growth than the shaded ones, and there was no appreciable difference in the amount of anthracnose and only a slight difference in the amount of downy mildew. Consequently it seems improbable that shading can be advantageously employed as a preventive of downy mildew.

The author reports the presence of the downy mildew (*Plasmopara cubensis*) on the winter crook-neck squash (*Cucumis moschata*), this being a new host plant for the fungus.

Suggestions on spraying, H. P. GOULD (*New York Cornell Sta. Bul. 144, pp. 579–586*).—Some notes on spraying are given to supplement the information contained in previous bulletins of the station. The summary is as follows:

"Many of the recently introduced insecticides and fungicides are no better than some of the older and better known materials, and they are sometimes inferior to them. Arsenite of lime prepared according to the directions of Dr. Kedzie seems to be the best substitute for Paris green. Powdered Bordeaux mixture has not given good satisfaction with us. Certain modifications of Bordeaux as proposed by Halsted may possess some advantages over the common formula for special purposes. In spraying for insect foes, the kind of material used must be governed by the feeding habits of insects for which the treatment is made. Bordeaux mixture seems to lessen the ravages of the striped cucumber beetle, as also the flea-beetle. Thoroughness in spraying is one of the most important elements of success and one often disregarded. Spray at the proper time. Under no conditions spray with poisons when fruit trees are in full bloom."

The present status of the biology of rust fungi, H. KLEBAHN (*Bot. Ztg., 56 (1898), II, No. 10, pp. 145–158*).

Recent investigations on grain rusts and other injurious fungi, A. B. FRANK (*Nachrechten aus Klub. Landw. Berlin, 1898, No. 388, pp. 3415–3418; 389, pp. 3421–3424*).

Notes on Puccinia lycii, P. MAGNUS (*Hedwigia, 37 (1898), Sup., No. 3–4, pp. 91–93, figs. 6*).

On the present status of the cereal rust question, J. ERIKSSON (*Ber. Deut. Bot. Gesell., 15 (1897), pp. 183–194; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 168, 169*).—The substance of this article has already appeared (E. S. R., 10, p. 316).

Recent observations of Eriksson on the rusts of cereals, C. B. PLOWRIGHT (*Gard. Chron., 3. ser., 24 (1898), No. 615, pp. 269, 270*).—Paper read before the British Mycological Society, September 19, 1898.

The asparagus rust, F. A. WAUGH (*Gard. Chron., 3. ser., 24 (1898), No. 607, p. 120*).—A brief account is given of *Puccinia asparagi* in the eastern United States.

Fungus diseases of hollyhocks, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 523, pp. 1342, 1343, fig. 1*).—Brief notes are given of *Cercospora althæina*, *Phyllosticta althæina*, *Colletotrichum althææ*, and *Puccinia malvacearum*.

Chrysanthemum rust, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 522, p. 1312, fig. 1*).—This disease is popularly described, and a warning against it is given to all growers.

Chrysanthemum rust, G. MASSEE (*Gard. Chron., 3. ser., 24 (1898), No. 615, p. 269, fig. 1*).—Notes are given of *Puccinia hieracii*, its occurrence and means for combating it. Reprinted in Amer. Gard., 19 (1898), No. 200, p. 727.

Wood ashes not an apple scab preventive, F. H. HALL (*New York State Sta. Bul. 140, popular ed., pp. 6*).—This is a popular summary of Bulletin 140 (see p. 452).

Experiments for preventing potato scab, TEICHERT (*Ztschr. Spiritusind., 1898, No. 13, p. 119*).

Experiments in infecting soil with potato-scab fungus, B. D. HALSTED (*Amer. Gard., 19 (1898), No. 181, pp. 435, 436*).—The experiments show the possibility of infecting soil with the fungus several months before planting the crop. The scabby tubers were applied directly and fed to stock and the manure applied with similar results.

Potato scab, R. HELMS (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 5, pp. 382-384*).—Popular notes are given on the cause of potato scab and suggestions for its prevention.

One cause of the brown or black rot of cabbages, E. F. SMITH (*Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 134-137, pl. 1*).—The author summarizes the results of his investigations on the black rot of cabbages due to *Pseudomonas campestris*. More extended accounts of the investigations have been given in Farmers' Bulletin 68 (E. S. R., 9, p. 849) and in Centbl. Bakt. u. Par., 2. Abt., 3 (1897), p. 284 (E. S. R., 9, p. 847).

A bacterial disease of mulberries, D. MCALPINE (*Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 142, 143*).—The author briefly describes a bacterial disease of mulberry twigs which has appeared in various parts of Victoria, Australia, and states that the specific organism is probably that described by Boyer and Lambert as *Bacterium mori*.

Club root of cabbage, P. HENNINGS (*Ztschr. Pflanzenkrank., 8 (1898), No. 2, p. 124*).—In a brief note the author states that the characteristic formations caused by *Plasmodiophora brassicæ* have been found on the *Nasturtium palustre* and *Raphanus raphanistrum*.

Sorghum blight and the bacteria which cause it, F. F. BRUYNING (*Arch. Neerland. Sci. Exact. et Nat., 1898, No. 4-5*).

Relation of temperature and growth of vine to black rot, G. CAZEAUX-CAZALET (*Rev. Vit., 1898, No. 217, pp. 173-179; 218, pp. 201-208; 219, pp. 229-233*).

Root rot of coffee, F. NOACK (*Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 137-142*).—The author describes a root rot of coffee, which is said to be due to nematodes. They appear to attack most severely the taproot, and the plant dies within a few years, dependent upon the vigor of the tree. The author states that by early and repeated local applications of carbon bisulphid the injury may be reduced to a minimum.

The violet disease, B. D. HALSTED (*Amer. Florist, 14 (1898), No. 541, p. 310*).—Notes are given on *Cercospora violæ* and *Phyllosticta violæ*, with suggestions for preventing their attacks.

Leaf spot and fruit rot of tomatoes, B. D. HALSTED (*Amer. Gard., 19 (1898), No. 183, p. 468, figs. 2*).—Notes are given of these diseases and methods followed for their prevention.

Phyllosticta hortorum on eggplants, B. D. HALSTED (*Amer. Gard., 19 (1898), No. 187, p. 531, fig. 1*).

A palm-leaf blight, B. D. HALSTED (*Amer. Florist, 13 (1898), No. 526, p. 1426, figs. 2*).—Illustrated notes are given of a blight of *Liristonia rotundifolia* due to *Colletotrichum* sp.

Exobasidium vitis, A. POTEBNIA (*Arb. Naturforsch.-Gesell. Charkow, 31 (1897), pp. 25-27, pl. 1; abs. in Bot. Centbl., 75 (1898), No. 4-5, pp. 122, 123*).

Concerning the destruction of barley by a new fungus parasite (*Separate from Wchnschr. Brau., 15 (1897), No. 42, pp. 2*).

The Bermuda lily disease, G. A. BISHOP (*Florists' Exchange, 10 (1898), No. 35, pp. 832, 833*).—A summary is given of the report of the author concerning this disease. It is said to be due to the following causes: Heavy manuring with barnyard manure; repetition of crop on the same ground; reduced vitality; bad selection of stock, and insufficiency of plant food. All these render the plant subject to fungus attacks. Directions for soils and manures are given, and where the plants are attacked by fungi and insects, spraying is recommended, formulas being given.

The lily disease in Bermuda, A. L. KEAN (*New England Florist, 4 (1898), No. 16, p. 183*).—Popular notes on this disease.

Gumming of stone fruits, S. A BEACH (*Amer. Gard., 19 (1898), No. 192, p. 606.*)—Compiled information on the cause of gumming of stone fruits.

Violet diseases, W. G. SALTFORD (*Amer. Gard., 19 (1898), No. 188, p. 545, fig. 1*).—Suggests remedial treatment.

Concerning the cause of the "sereh" disease of sugar cane, a review of the investigations and theories of Wakker, W. KRÜGER (*Deut. Zuckerind., 23 (1898), p. 225; abs. in Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 12, pp. 524–526*).

The influence of fertilizers on the diseases and injuries of the vine, P. COSTE-FLORET (*Influence des engrais sur les maladies et accidents de végétation de la vigne. Montpellier: Hamelin frères, 1898, pp. 31*).

The fungus foes of the farmer, B. D. HALSTED (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 678–692, figs. 6*).—The author figures and properly describes a number of the more common fungi which attack economic crops.

A review of the sugar-cane diseases of Java, II, L. ZEHNTNER (*Arch. Java. Suikerind., 1897, pt. 10, pp. 51; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 161–163*).—This part of the author's work on the diseases and enemies of sugar cane deals wholly with those injuries caused by animals.

Work upon some diseases of plants in 1897, F. H. HALL (*New York State Sta. Bul. 138, popular ed., pp. 6*).—A popular summary is given of the results published in Bulletin 138 of the station (see pp. 452–454).

Ear cockle in wheat, R. HELMS (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 4, pp. 280–283, figs. 2*).—The author figures and describes the effect of a nematode attack on wheat, the result being large gall-like formations in place of the grain. As a possible means for the prevention of the destructive attacks of this parasite the fallowing of fields and the alternation of crops are recommended.

An albuminous Bordeaux mixture, CAZENEUVE (*Vigne Franc., 1898, No. 4, pp. 51–53*).

Spraying for the destruction of fungi and insects, S. T. MAYNARD (*Massachusetts Hatch Sta. Bul. 52, pp. 15–19*).—The author gives formulas for the preparation and directions for the use of Bordeaux mixture, dilute copper sulphate, and kerosene emulsion. A spray calendar is given in which the time of application and fungicide or insecticide required is mentioned for the prevention of fungus and insect attacks on different fruits and vegetables.

Preventive treatment in plant disease—hybridization and inoculation, H. TRYON (*Queensland Agr. Jour., 2 (1898), No. 6, pp. 511–516*).—A discussion of inoculation for plant diseases and breeding resistant varieties.

ENTOMOLOGY.

Report of the entomologist, J. B. SMITH (*New Jersey Stas. Rpt. 1897, pp. 397–492, pls. 8, figs. 19*).—In the general review beginning his report the author notes the following insects and their injuries during the year: The army worm and Hessian fly, both of which seem to have disappeared; the pear midge, which seems to be actually stamped out in certain localities; the sinuate pear borer, which is held in check; the wood leopard moth; the maple pseudo-coccus, which is present in small numbers; the harlequin cabbage bug, which seems to have been decidedly checked by the cold, wet spring, and early summer; tomato louse; strawberry-root louse, troublesome in 1896 but apparently absent in 1897; the San José scale, to which more time was given than to any other insect; cutworms; leaf rollers; strawberry weevils, locally injurious; white grubs, reported as strawberry pests but not as seriously

injurious; potato beetles, for which arsenate of lead is recommended; a tortoise beetle (*Coptocycla clavata*), a new pest reported from Deckertown in June, where it was eating off potato stalks; rose chafers, which seem to be on the increase; *Lecanium tulipiferæ;* root webworms; *Crioceris 12-punctata;* cabbage worms; sawflies; *Selandria caryæ;* bagworms; codling moths; plum curculio; the round-headed apple-tree borer; pear-blister mite; pear slugs; fig eater (*Allorhina nitida*); *Procris americana;* and *Monahammus titillator.*

A study was made of Paris green as an insecticide. Samples were obtained from a large number of firms, and analyses made which showed that they ranged in arsenious oxid from 41.54 to 68.59 per cent. Variations were found even in different samples from the same manufacturer. Explanatory letters were received which, though not directly so stated, admitted the possibility of a variation of 15 per cent. This was not considered by the firm from which the letter came to be worth considering from a practical standpoint, but from this statement the author differs, stating that the "difference of even 10 per cent of arsenic may make all the difference between an effective and an ineffective application." From obtainable facts it appears that Paris green even under the best conditions varies greatly in the percentage of arsenic and that it may be present either as an arsenite or as an arsenate. Difficulties increase with the size of the quantities manufactured so that a difference of 25 per cent may exist in the absolutely unadulterated product. Hence it follows that the material as used by farmers is found to be unreliable and the results inconsistent. As an alternative the use of arsenate of lead is suggested. The formula given for it is 4 oz. arsenate of soda and 11 oz. acetate of lead dissolved separately and then mixed. The resulting solution is to be added to 100 gal. of water for most insects, to 80 gal. for more resistant insects, and to 50 gal. for potato beetles. This insecticide is strongly recommended.

Experiments were made with emulsion sprayers in which the emulsion was obtained by mechanical means, which developed considerable variation in the degree of reliability. The Success Emulsion Sprayer was found to be wholly unreliable with mixtures in the proportion of 1:20, which proportion was actually never obtained in the spray, the proportion ranging all the way from 1:100 to 1:15. Mixtures at the rate of 1:15 exhibited much less variation, the spray showing from 7.3 to 10.5 per cent of kerosene. At the rate of 1:10 and 2:10 the results were practically uniform.

Experiments were also made with kerosene, which are reported in considerable detail. The general conclusions have already been given in a preliminary bulletin (E. S. R., 7. p. 515), as were also the author's conclusions resulting from experiments with dendrolene and whale-oil soap, and from his study of the San José scale; but it may be noted in regard to the last insect that the author now finds it simpler to make a list of the plants that the insect does not attack rather than those

affected by it. A curious case of the persistence of the scale may be noted. One of the author's correspondents cut off his currant bushes early in the spring close to the surface of the ground, covering the stems with several inches of soil and allowing the young currant shoots to make their way through it. In most cases the scale made its way up through the soil and took possession of the shoots.

Concluding, the author thinks that every effort should be made to domesticate any known enemy of the scale, and that the introduction of Sphærostilbe should be systematically carried on until the disease exists in all places where the scale is known to occur. But this is advised not with the hope of extermination so much as the lessening of the cost of control. The author also notes that it would be advisable to investigate the question as to whether Japan is really the home of the scale. He thinks it is not beyond the bounds of possibility that Nature will in time come to the aid of the farmer, and states that had the present season continued wet throughout the scale would have lost ground everywhere and gone into winter quarters in an enfeebled condition.

Report of the department of entomology, C. M. WEED (*New Hampshire Sta. Bul. 48, pp. 138–145, figs. 8*).—Observations on the tent caterpillar. its food plants, parasites, etc., are reported. The author says:

"The list of food plants of the American tent caterpillar is long and varied, and when compared with other caterpillars a peculiar fact is noticeable. In most cases where the food is varied the insects confine themselves to certain orders of plants, usually nearly related to each other, but the prime requisite with the present species seems to be that the plants shall be of a shrubby nature. The members of the rose family seem to be the natural food of the tent caterpillar, and very few, if any, of the shrubby and arboreal members of this family escaped."

Notes are given on the forest tent caterpillar, and the differences between it and the common tent caterpillar are pointed out. The cankerworm has done considerable damage in some localities, but in regions where it was destroyed by spraying in 1895–96 the outbreak appears to have been checked. Brief notes are given on the codling moth, oyster-shell bark louse, and scale bug.

Insects of the year, G. H. PERKINS (*Vermont Sta. Bul. 60, pp. 3–16, figs. 5*).—The bulletin gives notes on the insects which have been most common during the year and suggests treatment. The army worm and the chinch bug did not injure crops during the season. Currant and cabbage worms, horn flies, railroad worms, and aphids gave considerable trouble. The forest tent caterpillar was unusually abundant and destructive, especially to the apple and sugar-maple trees, often defoliating them. The oyster-shell scale of the apple was very injurious in some orchards. The San José scale has appeared in one place in the State. The round-headed apple-tree borer was very troublesome in several localities. The flat-headed borer also gave some trouble, but was less injurious than in the preceding year.

Four injurious insects, D. A. SAUNDERS (*South Dakota Sta. Bul. 57, pp. 35–52, figs. 19*).—The author considers the Rocky Mountain locust (*Melanoplus spretus*), grain aphis (*Siphonophora avenæ*), spotted blister beetle (*Epicauta maculata*), and Uhler's green plant bug (*Lioderma uhleri*). The latter insect was first noticed in South Dakota in 1895. It has spread rapidly until it is now distributed over at least 10 counties. It is estimated that in 1897 3,500 acres of small grain and 800 acres of corn were totally destroyed by this insect. The young insect shows a special liking for turnips, radishes, potato blossoms, and young sweet corn. Cabbages, beets, and ruta-bagas were also attacked, but not well liked. Onions, parsnips, lettuce, tomatoes, carrots, and watermelons and cucumbers, were hardly touched.

"The insect inserts its bill beneath the epidermis of the soft, succulent part of the plant and draws so much nourishment therefrom that, especially where the bugs are abundant, the plant seldom recovers. Wheat is not disturbed until it is in the milk; the bugs then attack it in great numbers, 25 or more to a single head. A careful examination of many heads of wheat obtained from the infested regions fails to show any kernels that were missed by the bugs. The destroyed heads of wheat are as light as straw, there being nothing left in the chaff but the shrunken and shriveled hull of the grain. Sections made of such grains, the central part of which, in healthy grains, is densely packed with starch, is entirely empty and the gluten-containing cells contain but a few scattered grains.

The cornstalk is attacked early in the season; when it is a foot or two in length is when the greatest damage is done to it. In fact, if the bugs are numerous it is entirely destroyed. Later in the season they also attack the young ears, but at this time are not so destructive."

As to remedies, the author says: "Undoubtedly the best thing to do is to thoroughly and systematically burn every waste field, weed patch, and uncultivated ground." The burning should be delayed until all the bugs have come out of their winter quarters in the ground, unless the early ones begin to migrate. So far as known the bugs do not burrow in the native prairie.

The codling moth, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 142, pp. 69, figs. 21, pl. 1*).—Some general historical notes on the codling moth are given. The author estimates that from one-fourth to one-half of the annual apple crop of the United States is destroyed by the codling moth—more than by all other insects combined. Among the food plants of the insect are noted apples, pears, wild haws, crab apples, and quinces, and the insect sometimes works on such stone fruits as plums, peaches, and cherries. The insect is described and figured in its various stages. Its life history is discussed at length, many quotations being made from old as well as recent literature. In regard to the place and time of laying the eggs the author says:

"During the past two years we have seen hundreds of the eggs on apples in New York orchards, and have never yet seen one on or down in between the calyx lobes on the so-called blossom end. We have seen eggs near the calyx, in old curculio scars, near the stem, and have found what appeared to be codling moth eggs even

on the leaves of the tree. Most of the eggs we found were glued to the skin, apparently without much choice as to location, on the smooth surface of the fruit. . . .

"From the only definite evidence we have, one can not escape the conclusion that, in the northern half of the United States at least, most of the eggs of the codling moth are not laid until a week or more after the petals of the blossoms have fallen from most varieties of apples; or usually during the latter part of May and the first half of June.

"The date of the falling of the blossoms varies considerably in different years, depending upon the weather conditions which may cause spring to open early or late. As these same conditions affect the date of the emergence of the moths, in general the above statement regarding the egg-laying of the insect will hold good."

The habits of the insect and its work in all stages are considered in detail, the views of various writers being given together with observations of the author. The following résumé is given:

"The codling moth appears in the spring about the time the blossoms are falling from apple trees and after a few days glues its tiny scale-like eggs onto the skin of the young fruit or even the adjacent leaves, where they hatch in about a week. The little apple worm usually finds its way into the blossom end where it takes its first meal and where it remains feeding for several days, finally eating its way to the core. In about three weeks it gets nearly full grown and makes an exit tunnel to the surface, closing the outside opening of the tunnel for a few days while it feeds inside. Emerging from the fruit, it usually makes its way to the trunk of the tree where it soon spins a cocoon under the loose bark. Usually the first worms to thus spin up in June or July soon transform to pupæ, from which the adult insect emerges in about two weeks, and eggs are soon laid from which a second brood of the worms hatch. In most of the more northern portions of the United States only a part of the worms of the first brood pupate or transform to moths the same season, but in the central, western, and southern portions there is a complete second brood, and in some portions even a third brood of the worms annually. In the fall all the worms spin cocoons wherever they may be, either in the orchard or in storerooms, and remain curled up in them as caterpillars until spring opens, when they transform, through the pupa, to the moth, thus completing their yearly life cycle."

Among the natural enemies of the codling moth the following are discussed: Bats, said to be the most efficient destroyer of the moths in California; a parasite of the codling-moth eggs (*Trichogramma pretiosa*); a parasite of the larvæ (*Macrocentrus delicatus*); an external parasite of the larvæ (*Goniozus* sp.); hair snakes, sometimes found in larvæ before leaving the fruit; the larva of the Pennsylvania soldier beetle (*Chauliognathus pennsylvanicus*), which devours the larvæ while they are getting ready to spin or before they leave the apples; the larva of the margined soldier beetle (*C. marginata*), which probably enters the fruit to feed on the codling worm; the larva of the two-lined soldier beetle (*Telephorus bilineatus*); the larva of the beetle (*Trogosita corticalis*) which feeds on larvæ and pupæ on the trunks of trees and is considered, with the exception of birds, the most efficient enemy of the codling moth in New York; the larva of a similar beetle (*T. laticollis*) the larva of a neuropterous insect occurring in the West; a tachinid fly (*Hypostena variabilis*); an ichneumon fly, the ring-legged pimpla (*Pimpla annulipes*), the grub of which lives in the body of the larvæ and pupæ of the codling moth; and the birds, considered the most

efficient aids in controlling the codling moth. Of the work of birds the author says:

"In our experience it was almost impossible to find anything but empty cocoons on any part of the tree in the spring except on the trunk at the surface of the ground and for a distance of from six inches to a foot above. One finds such an astonishingly large number of empty cocoons that it would seem as though the birds must get the larger percentage of the worms which go into hibernation in the fall. Among the birds which thus include the apple worm in their menu are the downy woodpecker, nuthatch, black-capped titmouse, bluebird, crow blackbird, kingbird, swallows, sparrows, wrens, chickadees, and jays. It is probable that most of the birds which winter in any locality include the apple worm in their dietary."

A recent suggestion to import a bird which in Germany is an enemy of the codling moth is discouraged, the results of the importation of the English sparrow being cited as a warning. The author expresses the opinion that the larval stage is the most vulnerable of all the stages of the insect's life. The pupa stage is very short. The moths can not be entrapped by lights, and it is doubtful if the egg can be destroyed by any means which can be ordinarily employed. As to the ways of combating the larvæ the author discusses jarring and picking infested fruit from the trees, the destruction of windfalls, trapping worms on tree trunks by banding, and spraying. Windfalls must be destroyed promptly since the larvæ have been shown to leave the fruit soon after it falls. Bands must be examined every 10 days from June until the latter part of August. After that it will not be necessary to disturb the bands again until late in the fall. The cost of this method of treatment during the season is considered to be about 4 cts. per tree. To show the reason for spraying soon after the blossoms fall, young apples and pears are figured. It is suggested that the greater success commonly observed in spraying apples than in spraying pears may be due to the fact that in the former the calyx lobes close up and hold any poison the calyx cup contains, while in the latter the lobes remain open and allow the poison to be washed away.

By way of summary the author says:

"Briefly stated, no panacea for the codling moth has yet been found, but by thorough work by a Paris-green spray, we can often save at least 75 per cent of the apples that would otherwise be ruined by the worms. Where more than 2 broods of the insect occur during the season, as in Kansas, Nebraska, Oregon, New Mexico, and neighboring localities in the West and in the South, the poison spray is not so effective, for although 75 per cent of the first brood of worms may be killed with the spray, the few worms left will form a sufficient nucleus for a large and very destructive second or third brood; in these localities the best that can be advised at present is to supplement the poison spray with the old banding system.

"To use the poison spray the most effectually, one must understand that it is necessary to fill the blossom end of each apple with poison within a week after the blossoms fall, for this is where the little apple worm gets its first few meals, and it is practically our only chance to kill it with a spray. Watch the developing fruit after the petals fall and be sure to apply the poison before the calyx lobes close, for while the falling of the blossoms is the signal to begin spraying, the closing of these calyx lobes a week or two later is the signal to stop spraying.

"While we thus have no new methods to offer and doubt if anything better than the poison spray will be found for combating this insect, we believe a better understanding of 'whys and wherefores' of the methods already in use will insure still greater success with them."

The bulletin contains a "bibliography of the most important contributions to the economic literature of the codling moth." The references, about 100, are arranged chronologically and date from 1635 to the present time.

Observations on the codling moth, F. W. Card (*Nebraska Sta. Bul. 51, pp. 11–50, figs. 5*).—The bulletin gives original observations on the life history and habits of the codling moth, and the results of field and laboratory tests of remedies. The author points out the fact that in the West the remedies usually recommended for the moth have failed to give satisfactory results and that the habits and life history of the insect are not in accord with the statements made in the older literature of the subject, especially with regard to the eggs being deposited in the open calyx cup at the time of blossoming or soon after. Most varieties of apples in the station orchard in 1897 blossomed in the first of May and the calyx cups had practically all closed by the twentieth. The life history of the insect as given by the author is as follows:

"The first moths begin to emerge late in May. These deposit their eggs chiefly upon the upper sides of the leaves near by an apple. These eggs hatch in 8 or 10 days, more or less, according to the weather. The tiny larva, when it emerges, soon begins to seek for an apple in which to feed, though in some cases not until it has eaten out a small portion of the leaf near where it hatches. It seeks for a hiding place to protect it from its enemies, and the one most frequently available is that formed by the calyx lobes, which have closed, thus preparing a very safe and convenient dwelling until it can work its way into the fruit. These larvæ begin appearing about June 1, varying somewhat with the season. They soon make their way to the center of the apple, eating out the portion about the core. When full-grown, which apparently occurs in from 10 to 14 days, they become pinkish in color, usually leave the fruit, and hunt for a convenient hiding place in which to spin their cocoons. Such a spot is commonly found beneath rough pieces of bark on the trunk of the tree. Apparently they leave the fallen apples and crawl up the trunk, or they may leave the apple when still upon the tree and crawl downward. The rough bark found at the forks between large branches is a favorite place, also injured portions where rotten wood or similar conditions occur. Sometimes they may change to pupæ within the apple, and Mr. Nutter expresses the opinion that the majority thus transform. This is common in confinement, but in our own observations we have never found pupæ in the apples about the orchard. The second generation of moths emerges about a month, or possibly a little more, after the eggs are laid. They are very irregular in time. Many moths are tardy in emerging from their winter quarters. These may pass through not more than two generations during the season, while those which emerge very early may pass through as many as four; consequently, to say that the codling moth is two-brooded, or three-brooded, or four-brooded is not to express the full truth, some being one, some another. Apparently the greater number pass through three generations. Few, if any, larvæ transform to pupæ after September 1. From that time forward they weave themselves thicker cocoons than in summer, preparing to pass the winter within them. Those which are still in the apple may be harvested with the fruit and thus find

their place for transformation in crevices or among the refuse in the bins or barrels. The winter is passed in the larval stage, the change to pupæ being made in spring, and from thence the summer campaign as a moth is begun."

In discussing remedies the author notes the fact that the usual recommendation is to spray the trees with some arsenite as soon as the blossoms fall and repeat once or twice at intervals of ten days or two weeks, and shows that following this recommendation the first spraying would be made in Nebraska nearly a month before the larvæ appear. The only object of spraying early is to get a particle of poison into the calyx cup before the calyx closes. From observations extending over two seasons it was estimated that about 80 per cent of the wormy apples were entered by the calyx end. The author believes that the chances are against spraying affecting the 20 per cent of the larvæ which enter the apple outside of the calyx, and notes the fact that if this percentage of the first brood were to continue propagating itself throughout the season the crops of late apples might be nearly ruined. An attempt to trap the larvæ with sticky fly paper after they leave the apples to pupate resulted unsatisfactorily. The use of bands around the trees gave good results. Paper bands were applied in different ways, some being folded to allow the larvæ to enter between the folds. Out of 368 pupæ found on banded trees 322 were under the bands. In regard to this work the author says:

"It would seem from these results that the larvæ prefer the rough bark near the ground, and most of them get next to the bark, no matter how close the paper may be tacked to the tree, so that putting on the double fold with the hope of trapping them between the layers and thus quickly destroying them can not be depended upon."

Experiments at the station in spraying with Paris green were not entirely satisfactory on account of the unfavorable condition of the trees. From an examination made June 21 it was found that trees sprayed only on June 1 seemed to have been as well protected as those sprayed two or three times. The sprayed trees were, however, much freer from wormy fruit than unsprayed trees. Late spraying was tried on a very small scale in 1896. On July 10 a part of a tree was sprayed and on August 11 the apples were examined, with the result that 82 per cent of those taken from the unsprayed portion were wormy as against only 26 per cent of those taken from the sprayed portion. The spray used was very strong and injured the foliage so seriously that many of the leaves fell and the growth of the fruit was checked.

Various mixtures were tried in an attempt to find something that would adhere better than Paris green. The addition of sorghum to the spray gave no beneficial results. The addition of one tablespoonful of rye flour to a pailful of water added to the adhesiveness of the mixture. Lead arsenite adhered better than Paris green. Bordeaux mixture adhered well, and it is suggested that it may be mixed with arsenites to render them more adhesive.

From laboratory experiments with Paris green, Bordeaux mixture

and Paris green, and whale-oil soap, it was found that each of the substances has some value when used before the eggs hatch, but that neither of them destroy the eggs or are entirely effective in killing the larvæ. Apples sprayed with kerosene emulsion, one part standard mixture to 20 parts water, before the eggs hatched were entirely uninjured by larvæ, the eggs in some cases being apparently killed by the emulsion, and in all other cases the larvæ being killed before injuring the fruit. A single experiment in the field indicated that kerosene emulsion may be used to advantage against the codling moth.

Cooperative experiments were carried on at different places in the State. At Gibbon 1,700 trees were treated. Four sprayings were made with Paris green, 1 lb. to 200 gal. water. On harvesting the apples 80 per cent were found free from worms and in half of the other 20 per cent the damage was very slight. It is thought the percentage of wormy apples would have been greater had not many of the moths been killed in the storage rooms. The previous year, when the trees were unsprayed, not over 20 per cent of the apples were salable. At Arlington an orchard was divided into 6 sections, from 2 to 6 applications of Paris green being made at various dates in each of the sections. There was no marked difference in results in the different sections of the orchard, due, it is thought, to the fact that the moths go from one section to the other to deposit eggs for the late broods. There was considerable difference in the percentage of wormy apples of different varieties. For instance, 44 per cent of the Janet apples were wormy, as against only 20 per cent of the Ben Davis. At Geneva about 1,000 trees were sprayed twice with London purple at a total cost of only 2 cts. per tree. Another orchard was sprayed but once. The results were in favor of 2 sprayings.

The author gives the following suggestions for treatment:

"Spray with Paris green as generally recommended, about one week after the blossoms fall, or in time to get the calyx cups well filled with the poison so that they may close over and hold it there.

"Spray again with Paris green and Bordeaux mixture combined, or with kerosene emulsion, about June 1, or better still, observe carefully and apply this when the eggs are being laid in abundance on the leaves, which at Lincoln occurs about this date. Laboratory experiments indicate that kerosene emulsion will be more effective than Paris green at this time.

"Scrape the bark and place paper bands around the tree about the last of June, when the larvæ are beginning to leave the apple to pupate. Examine these two or three times, a week apart, and destroy the insects found beneath them.

"If these methods are not wholly effective, owing to the proximity of neglected orchards, or from an unusual abundance of moths, later spraying, with either Paris green and Bordeaux mixture, or kerosene emulsion, may do some good, but apparently can not be expected to be wholly effective. Late spraying with arsenites is much more likely to injure the foliage than earlier applications, and if the other methods are thoroughly followed, it will probably be unnecessary.

"If larvæ are still found in the apples in any considerable numbers toward the end of the season, place paper bands about the tree about September 1, or a little earlier. Leave them there until the fruit is gathered from the orchard, then remove, and destroy the larvæ hibernating beneath them.

"Screens placed over the windows and doors of the cellar or rooms where apples have been stored will prevent those larvæ which are taken in with the apples from escaping as moths in the spring."

The Orthoptera of Minnesota, O. LUGGER (*Minnesota Sta. Bul. 55, pp. 91–386, figs. 188*).—The bulletin gives the distribution, structure, and habits of the more destructive species of locusts, with methods of combating them; remedies for cockroaches and other orthopterous insects; an account of the parasites and other natural enemies of locusts; a description of the external anatomy of the two-striped locust (*Melanoplus bivittatus*); an account of the internal structure and metamorphosis of locusts; and a classification and technical description of the species of Orthoptera occurring in Minnesota.

In regard to remedies against locusts the author says:

"The true remedy consists in plowing, and wherever locusts are numerous this method has to be employed. Plow the soil containing the eggs during the autumn, if possible, as by doing so the surface of the plowed ground becomes thoroughly compact by wind, rain, and snow. Plowing in spring, if well done, and as early as possible, will also be successful, though in some cases, and especially in a dry season, a few locusts may succeed in reaching the surface."

To determine whether young locusts can reach the surface in plowed ground, eggs of *Melanoplus spretus* and *M. atlanis* were planted at different depths in flower pots containing soil similar to that from which the eggs had been removed. In one lot the soil was moistened occasionally and in the other kept dry. The results are shown in the following table:

Percentage of locusts reaching surface of soil with eggs placed at different depths.

Depths at which eggs were placed.	Soil kept dry.	Soil moistened.
	Per cent.	*Per cent.*
One inch	93	87
Two inches	86	43
Three inches	51	11
Four inches	13	1
Five inches	2	0
Six inches	0	0

Where locusts are not numerous enough to warrant plowing, burning the grass may be useful. Where eggs are deposited in large numbers in restricted areas, much good may be done by collecting and destroying them. To do this, especially where the soil is light, about an inch of the surface soil is removed and the eggs sifted out and buried. In case it is impracticable to plow, as in meadows and pastures, much good may be accomplished by poisoning the edges of adjoining grain fields. Locusts may also be poisoned in gardens by using poison bran mash as a bait. Hopperdozers are considered very useful in destroying locusts, but are "only a makeshift, to be employed when better remedies can no longer be used."

Cottonwood-leaf beetle; green arsenite, V. H. LOWE (*New York State Sta. Bul. 143, pp. 23, pls. 6*).—The results of a study of *Lina scripta* in its relation to the willow industry of the State during the last 2 years. During this time and the 2 years preceding the beetle in both adult and immature stages caused very serious injury to the willow industry by attacking the willow whips, causing them to branch and thus making them unfit for basket purposes. In experimental fields the willows were successfully protected by 3 applications of green arsenite in the proportion of 1 lb. to 100 gal. water. Other mixtures were also tried, among them green arsenite and whale-oil soap, 1 lb. of the latter being added to each 20 gal. of the mixture of the former.

Machines are figured and described which consist of a boat-like receptacle in which water is placed and covered with a film of kerosene; the beetles and larvæ are knocked into this receptacle as the machines are pushed or dragged between the rows of willows. The author recommends spraying the young trees until they are large enough for the machines, and using the machines after the trees are too high for thorough spraying by ordinary means. The importance of united efforts by willow growers is pointed out.

Green arsenite or Scheele's green, with which the experiments were made, is thought superior to Paris green; for in addition to its low cost it remains in suspension longer. When Paris green is mixed with water at the rate of 1 lb. to 150 gal. it sinks to the bottom within about 5 minutes, but green arsenite will remain in suspension for over 2 hours. The use of lime with the poison is recommended.

Plant lice—descriptions, enemies, and treatment, V. H. LOWE (*New York State Sta. Bul. 139, pp. 646–664, pls. 4*).—The bulletin discusses the classification and life history of plant lice, how they obtain their food, their natural enemies, remedies used in combating them, etc. The species of plant lice which were under observation are *Hyalopterus pruni* and *Myzus ribis*. The former are abundant on the plum and the latter on the currant. These are described, their distribution, life history, and food habits are noted, and partial bibliographies of each are given. Other species of plant lice attacking the plum and currant are noted.

Among the natural enemies of plant lice the author considers the following predaceous insects: *Anatis ocellata*, *Coccinella 9-notata*, *Adalia bipunctata*, *Megilla maculata*, an undetermined beetle, larvæ of the syrphus fly, and aphis lions, and the following parasitic insects: *Aphidius polygonaphia*, *Pachyneuron aphidivorus*, and *Isocratus vulgaris*.

Experiments were conducted in spraying with whale-oil soap, on which the following recommendations are based:

"Do not wait for the leaves to become curled, but spray thoroughly as soon as the first few lice are observed. Much depends upon the thoroughness of the first application. Direct the spray from below so as to drench the under surface of the leaves. Use a solution of good whale-oil soap, not weaker than 1 lb. to 7 gal. of water.

When the spraying has been neglected until the leaves have become badly curled, trim off the curled tips and spray at once with the whale-oil soap solution. This applies especially to fruit trees. In the case of currants and gooseberries, it will sometimes be found practical to pick off and destroy the leaves which are first infested in the spring."

Brief notes on the San José scale, H. P. GOULD (*New York Cornell Sta. Bul. 144, pp. 587–592, fig. 1*).—This consists of notes on the occurrence of the San José scale at Cornell University, methods of treatment, natural enemies, etc. The following summary is given:

"Whale-oil soap used at the rate of 2 lbs. to a gallon of water will kill the scale, but its use is more or less restricted on account of its consistency when cold and from the fact that it injures the foliage and buds if they are in other than a dormant condition. Kerosene applied at the rate of one part kerosene to four of water will destroy the scale. The results of spraying in the spring, compared with those obtained from late fall or early winter indicate that the scale is more susceptible to the action of insecticides in the spring than it is in the fall. Whale-oil soap in solution may be applied by means of a pump while it is hot, but after it becomes cold a brush or some similar implement is necessary to do thorough work. A spray pump with kerosene attachment is the most convenient apparatus for applying kerosene. There are several insects and fungus enemies of the scale, but it is yet doubtful if they are of much economic importance in the North. The San José scale does not seem to be very difficult to kill when insecticides are brought in contact with it. The difficulty arises chiefly from the fact that the scales are often more or less protected by the roughed bark, crevices, and other natural conditions of the host, and from the rapid increase of the pest. Great care and thoroughness are of paramount importance. When the work is thoroughly well done and frequently repeated, satisfactory results may be expected."

Inspection of nurseries and treatment of infested nursery stock, V. H. LOWE (*New York State Sta. Bul. 136, pp. 573–602, pls. 6*).—This bulletin gives an account of the inspection of nurseries in western New York and discusses the more important insects found. Experiments are reported in treating young stock infested with lice, in fumigating nursery stock, in spraying young grafts, etc. The following summary is given:

"Most of the nurseries inspected have been found practically free from insect pests of a serious nature. Ten important species have been found at different times, however, in sufficient numbers to do serious injury. In all cases efforts were at once made to clean out the stock thus infested. The most important insect which attacks nursery stock in this State is the San José scale. It is important to nurserymen not only because of the injury which it may do to the infested stock, but because it is greatly dreaded by both dealers and fruit growers alike. Hence stock from a nursery which is known to have been once infested does not find a ready sale.

"Experiments in dipping and spraying young nursery trees indicate that plant lice may be controlled in the nursery by dipping the curled tips of infested trees in a solution of whale-oil soap, 1 lb. to 7 gal. of water. The work should be done early in the season. Flea-beetles attacking young pear and apple trees may be held in check by spraying with green arsenite, 1 lb. to 100 gal. of water, and the cankerworm will succumb to the same treatment.

"The experiments in fumigating nursery stock with hydrocyanic-acid gas, when the stock is piled in the cellar for winter storage, indicate that this method may prove practical, thus avoiding the necessity of building special fumigating houses."

The peach-tree borer, C. F. BAKER (*Alabama Sta. Bul. 90, pp. 27–32, figs. 3*).—The characteristics and life history of the peach-tree borer are noted. The following remedies are suggested: Cutting out the larvæ and preventing the larvæ from entering the tree by tying tarred or building paper about the trunks or coating the trunks with a mixture to poison the larvæ or prevent their boring in. For the latter, whitewash with the addition of Paris green and soap or glue is recommended. White lead should be used with caution and only on old trees, as young ones may be injured by it. Painting tree trunks with the sediment of Bordeaux mixture resulted successfully. Dendrolene was applied to mature peach and plum trees, with the result that one-half of the trees were killed and the others seriously injured.

The fruit-bark beetle, C. F. BAKER (*Alabama College Sta. Bul. 90, pp. 33–37, figs. 5*).—The fruit-bark beetle is described and figured and its life history, distribution, and method of attack are noted. Burning badly infested trees, the application of whitewash to trunks and branches, and thorough culture are recommended as the best means of dealing with this insect.

The production of honey, W. S. PENDER (*Agr. Gaz. New South Wales, 9 (1898), No. 8, pp. 897–907, figs. 3*).—A paper presented before the Hunter River Agricultural and Horticultural Association, with a discussion.

Notes on the habits of some burrowing bees, J. B. SMITH (*Science, n. ser., 8 (1898), No. 195, p. 399*).—Notes are given on the burrows of *Colletes compacta, Andrena bicolor, A. vicina,* and *Augochlora humeralis.*

The periodical cicada in 1898, E. A. SCHWARZ (*U. S. Dept. Agr., Division of Entomology Circ. 30, 2. ser., pp. 3*).—It is noted that 2 broods of the cicada will make their simultaneous appearance this year, a 17-year brood at various places, from Wisconsin in the West to New York in the East, commencing to appear in the latter part of May; and a 13-year brood on both sides of the Mississippi River, from near the mouth of the Missouri southward to Louisiana, commencing toward the end of April. The list of localities where the insects will occur is given alphabetically.

Insects injurious to wild and cultivated roses in France, E. LUCET (*Les insects nuisibles aux rosiers sauvages et cultivés en France. Paris: Paul Klincksieck, 1898, pp. 356, pl. 13, figs. 170; rev. in Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 188, 189*).—The work gives description and habits of these injurious insects, together with means for their destruction.

A review of the useful and injurious insects of Java, J. C. KONINGSBERGER (*Meded. S'Lands Plantentuin, 22 (1898), p. 53*).

The fruit-tree bark beetle, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Circ. 29, 2. ser., pp. 8, figs. 4*).—The circular considers briefly the general characteristics, methods of work, life history, and distribution of the fruit-tree bark beetle, its parasitic enemies, remedies, food, etc. Clean culture, burning badly infested trees, treatment of infested spots with kerosene emulsion, the use of deterrent washes, such as whale-oil soap, soap and carbolic acid, soap and soda, and similar remedies are noted.

The fruit fly (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 3, pp. 212, 213, figs. 2*).—A note is given, in which it is stated the recent investigations show that the fruit fly in Australia winters in two weeds (*Solanum sodomæum* and *S. nigrum*).

Tobacco-leaf miner, G. McCARTHY (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 721–726, fig. 1*).—A popular article dealing with the characteristics, habits, life history, and distribution of the tobacco-leaf miner, with notes on remedies.

A destructive beetle and a remedy, F. H. HALL and V. H. LOWE (*New York State Sta. Bul. 143, popular ed., pp. 8, pls. 3*).—This is a popular edition of Bulletin 143 of the station (see p. 467).

Three serious insect pests of eastern Australia, A. M. LEA (*Producers' Gaz. and Settlers' Rec.* [*West. Australia*], *5* (*1898*), *No. 3, pp. 171–174, fig. 1*).—The codling moth (*Carpocapsa pomonella*), Queensland fruit fly (*Tephritis tryoni*), and light-brown apple moth (*Cacœcia responsana*) are briefly considered.

Bibliography of the more important contributions to American economic entomology, VI, N. BANKS (*U. S. Dept. Agr., Division of Entomology, pp. 273*).—This is part 6 of the bibliography begun by Mr. Henshaw and comprises the more important writings published between June 30, 1888, and December 30, 1896. Over 3,950 titles are listed.

Combating plant lice, F. H. HALL (*New York State Sta. Bul. 139, popular ed., pp. 5, pls. 4*).—This is a popular edition of Bulletin 139 of the station (see p. 467).

Killing aphis by vaporizing tobacco, J. N. MAY (*Amer. Florist, 13* (*1898*), *No. 522, p. 1318*).

The phyllogeny of North American Eucleidæ, H. G. DYAR (*Science, n. ser., 8* (*1898*), *No. 195, p. 400*).—This is a brief abstract of a paper read before Section F of the American Association for the Advancement of Science at its meeting in August, 1898.

Cyanid of potassium as an insecticide (*Gard. Chron., 3. ser., 24* (*1898*), *No. 603, p. 50*).—Editorial notes are given on the use of this substance as an insecticide, and the author states the success which has attended its use in the United States warrants its trial in England.

Hydrocyanic acid as an insecticide, J. FISHER (*Amer. Gard., 19* (*1898*), *No. 201, p. 741*).—The author describes his method of using hydrocyanic-acid gas to destroy insects in greenhouses.

Petroleum as an insecticide (*Bl. Zuckerrübenbau,* (*1898*), *No. 3, pp. 72–76*).

Arsenate of lead as an insecticide, K. SAJÓ (*Ztschr. Pflanzenkrank., 8* (*1898*), *No. 3, pp. 173–175*).—Notes are given on the preparation, use, and efficiency of this insecticide.

Spraying calendar for 1898, L. R. TAFT (*Michigan Sta. Bul. 155, pp. 291–307*).—The bulletin gives a list of plants with directions for spraying each, a list of insect and fungus pests with directions for the treatment of each, and a list of fungicides and insecticides with directions for the preparation of each.

Legislation relating to insects and diseases of fruit trees, and preliminary report of the State inspector of nurseries and orchards, L. R. TAFT and D. W. TRINE (*Michigan Sta. Bul. 156, pp. 309–320*).—The bulletin gives the text of the San José and nursery inspection law of Michigan, a list of nurserymen and dealers who have taken out licenses according to the law, notes on other legislation relative to insects and diseases of fruit trees, etc.

FOODS—ANIMAL PRODUCTION.

A calorimeter for the human body, W. MARCET (*Proc. Roy. Soc.* [*London*], *63* (*1898*), *No. 396, pp. 232–242, figs 2*).—The author describes a calorimeter of suitable size for experiments with man. It consists of a wooden chamber lined with polished sheet copper. The capacity is 810.4 liters. The 2 walls are separated by a space of 45 cm. The outer wall is padded on the inside with cotton wadding and on the outside with several thicknesses of felt. There is a movable panel of the same construction as the walls which serves as a door. It is made to press tightly against a rubber cushion around the rim and is held in place with brass screws. This panel contains a window. Inside the chamber there is a chair in which the subject usually sits during the experiment.

The chamber is further provided with 2 fans which thoroughly mix the air and are so arranged that the current is not unpleasant to the person experimented upon. A vessel containing ice is suspended in the chamber and the water formed by the melting ice is collected in flasks suitably arranged. Comparatively little of the heat in the chamber is lost, since it is reflected from the walls. The heat generated causes the ice to melt and the amount of heat can be calculated from the amount and temperature of the water produced. In experiments due allowance is made for the heat generated by the revolution of the fans, and other necessary corrections are introduced.

Experiments to test the accuracy of the apparatus were made by introducing a jar of hot water into the chamber or by burning hydrogen gas. From these the author concludes that the calorimeter is very accurate. The calorimeter is so arranged that the respiratory products may be collected outside the chamber for analysis.

An experimental inquiry into the heat given out by the human body, W. MARCET and R. B. FLORIS (*Proc. Roy. Soc.* [*London*], *63* (*1898*), *No. 396*, *pp. 242–255*).—Using the calorimeter described above, the authors made a number of experiments with men of various ages. In some of the experiments the authors themselves were the subjects. In several instances the respiratory products were collected for analysis. The air was inspired through the nose and expired through the mouth, a face piece with suitable tubes being worn. The usual plan was to collect the air expired for periods of twenty minutes to half an hour throughout the experiment. The author believes this gives a means of accurately determining the composition of the air expired while in the calorimeter, as the subject remains at rest. In one experiment the total respired air was collected and it was found that the volume expired in half an hour was proportional to the volume expired in one hour. The experiments were generally of an hour's duration and were made before and after eating and varied in other ways. The results are summarized as follows:

"(1) The amount of heat given out from the human body when tested on 2 successive half hours is found to be the same when the means of the calories are taken, although in each separate experiment the heat emitted may vary to some slight extent.

"(2) The heat emitted by the same person varies, and the extent of this variation is wider in some subjects than in others. Thus, in one case the calories emitted in one hour from 26 experiments varied from 122,124 to 80,639, or by 33.9 per cent of the larger figure. In 21 experiments with another subject they varied from 106,839 to 80,985, or by 24.2 per cent; and with a third subject in 11 experiments from 137,078 to 111,754, or by 18.5 per cent.

"(3) As a fact, irrespective of theory, the mean number of calories found from 3 different persons, under similar circumstances of food, etc., corresponding to 1 gm. of oxygen absorbed from the air, was the same, and can be stated in round numbers at 4,000. Had more experiments been done fasting, this figure would have shown a slight tendency to fall.

"(4) Although the mean calories per individual for 1 gm. oxygen absorbed under similar circumstances of food, etc., are the same, still, in the experiments taken singly, the number of calories corresponding to 1 gm. oxygen absorbed vary, and this

in a regular way. The greater the heat given out, the greater the calories produced for 1 gm. oxygen absorbed, and vice versa. Therefore, either a given amount of oxygen absorbed can produce different quantities of heat, or the oxygen found as absorbed does not represent that to which the heat is due. This second alternative appears the more probable.

"(5) The influence of a meal, as ascertained on 3 different persons, is well marked. Taking the midday meal, when mixed food is eaten, generally with a good appetite, the calories emitted about 2 hours after lunch show an increase over those given out about 3 or 4 hours after breakfast. The excess varies in different persons and according to the kind and amount of food taken.

"(6) The calories emitted per kilogram weight of the body are subject to marked variations in different persons."

The feeding value of salt-marsh hay, J. B. LINDSEY and B. K. JONES (*Massachusetts Hatch Sta. Bul. 50, pp. 3–19, figs. 5*).—The composition and digestibility of 6 different varieties of salt-marsh hay are reported, together with illustrated descriptions of the salt grasses, remarks on the harvesting of salt hay, etc. It is stated that there are in Massachusetts about 23,000 acres of salt marsh, yielding some 21,000 tons annually, valued at $193,000. "Large quantities of salt hay are used for litter, and for packing, while large amounts of the best grades are fed to horses and neat cattle."

The hays included in this study were black grass (*Juncus gerardi*), fox grass (*Spartina patens*), branch grass (*Distichlis spicata*), redtop variety containing considerable sedge, cove mixture (a mixture of the redtop variety and black grass), salt-hay mixture (a mixture of branch grass, fix grass, and flat sage), and flat sage (*Spartina stricta maritima* var.?).

The hay of black grass was rather damp and smelt moldy and was not relished by the animals, although they ate it. The branch-grass hay was in poor condition being very damp with a musty smell; it was not eaten readily by the animals.

The composition of the hay as compared with that of common hay was as follows:

Composition of hay of salt grasses.

	Water.	In dry matter.				
		Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
English hay	13.00	7.55	2.48	48.40	36.68	4.89
Black grass	16.00	8.71	2.48	52.23	28.71	7.87
Fox grass	17.00	8.76	2.46	54.31	26.96	7.51
Branch grass	21.00	7.87	2.82	55.00	26.46	7.85
Redtop	13.00	7.80	1.82	51.54	32.32	6.46
Cove mixture	18.00	8.82	2.10	54.32	27.57	7.19
Salt-hay mixture	16.00	6.48	2.51	54.26	26.77	9.98
Flat sage	17.00	7.82	2.91	49.77	29.71	9.79

"In chemical composition they quite closely resemble an average quality of English hay. They contain about the same amount of protein, less fiber, and rather more extract or starchy matter, and ash. The excess of ash is due to the presence of salt. In fertilizing constituents, the same amount of nitrogen was found as in English hay and two-thirds as much phosphoric acid and potash."

Digestion experiments on each kind of hay were made with sheep. Each sheep was fed 400 gm. of common hay and 500 gm. of salt hay daily, and from the results the digestibility of the salt hay was calculated. The results are summarized below:

Digestibility of salt-marsh hays.

	English hay for comparison.	Black grass.	Fox grass.	Branch grass.	Redtop.	Cove mixture.	Salt-hay mixture.	Flat sage.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Protein	54	54	59	52	37	48	42	52
Fiber	58	57	57	25	56	60	58	60
Extract matter	56	49	53	46	46	53	52	55
Fat	40	46	36	37	49	40	28	36

The results with branch grass are believed to be abnormal.

From the composition and the digestibility calculations are made of the amounts of digestible nutrients in 1 ton of the different hays as compared with common hay. The relative values of the salt-marsh hays containing 18 per cent of moisture as compared with English hay containing 14 per cent of moisture are given as follows: English hay 100, black-grass hay 90, fox-grass hay 85, branch-grass hay 84, redtop variety 84, cove mixture 88, salt mixture 82, and flat sage 88.

Formulas are given for grain mixtures to be fed with salt-marsh hay.

The digestibility of several sorts of distillery refuse, O. KELLNER, ET AL. (*Landw. Vers. Stat., 50 (1898), No. 3-4, pp. 297-316*).—Experiments were made with 2 sheep on the digestibility of 5 sorts of distillery refuse. For purposes of comparison 3 tests were also made in which the only food consisted of meadow hay. As shown by microscopical analyses the different sorts of distillery refuse were made up as follows: (1) Maize and rye with some potato and barley; (2) largely oats and maize with a little barley; (3) maize, barley, and oats; (4) rye, maize, and oats with a little barley; (5) barley and maize with rye and potato. The composition of the different sorts of refuse is reported, as well as a number of tests on the best methods of determining dry matter and fat in distillery refuse and similar products. Two hundred grams of distillery refuse No. 1 was fed with 800 gm. of meadow hay, and in the other cases 300 gm. was fed with the same quantity of hay. The coefficient of digestibility of the refuse alone was calculated from the digestibility of the whole ration, using the value found for hay. The average coefficients of digestibility for the 2 sheep are shown in the table following.

Coefficients of digestibility of distillery refuse.

	Dry matter.	Organic matter.	Crude protein.	True albuminoids.	Fat.	Nitrogen-free extract.	Crude fiber.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Meadow hay	62.4	64.6	57.0	68.5	56.7	68.5	60.5
Distillery refuse I (maize, rye, some potato and barley)	61.2	66.7	49.1	48.6	94.2	67.6	67.1
Distillery refuse II (largely oats and maize with a little barley)	59.2	60.4	79.5	86.0	93.7	53.8	45.6
Distillery refuse III (maize, barley, and oats)	78.5	81.1	68.6	73.8	94.3	82.9	91.8
Distillery refuse IV (rye, maize, oats with a little barley)	74.2	76.1	63.8	63.8	91.9	82.1	69.1
Distillery refuse V (barley and maize with rye and potato)	70.9	74.8	58.5	55.1	93.6	85.0	40.5

Concentrated feed stuffs, J. B. LINDSEY (*Massachusetts Hatch Sta. Bul. 53, pp. 21, figs. 3*).—In addition to definitions of terms used and a description of a number of feeds, the bulletin contains a report of the first official inspection of concentrated feeding stuffs in Massachusetts.

"[Analyses are reported of] 4 different brands of gluten meal, 5 brands of gluten feeds, 10 different makes of wheat bran, 19 distinct brands of middlings, 22 different mixed feeds, besides a great variety of other feed stuffs, many without manufacturer's name or brand. The total number of analyses was 265.

"The inspection shows the feed stuffs to be comparatively free from serious adulteration. Some show rather wide variations in composition, which it is hoped will be corrected in the future.

"Many new materials, by-products from various industries, are constantly appearing, frequently without name, brand, or guaranty. This leads to much confusion as to feeding and actual commercial value on the part of the buyer. Materials of this character ought not to be purchased without a guaranty of quality. Guaranteed articles ought always to be given the preference."

The author discusses the comparative commercial value of different feeding stuffs on the basis of nutrients contained in them, and suggests a number of grain mixtures to be fed with coarse fodders to dairy cows.

Fodders and feeds, E. B. VOORHEES and J. P. STREET (*New Jersey Stas. Rpt. 1897, pp. 76, 77*).—Analyses (food and fertilizing constituents) are reported of oats and peas, Japanese millet, cowpeas, soy-bean vines, barley and peas, green rowen, corn (stalks, kernel, cob, etc.), corn stover, corn fodder, corn silage, timothy and clover hays, shelled corn, corn sprouts, Atlas gluten meal, H. O. Feed, wheat bran, dried brewers' grains, and linseed meal. Japanese millet was shown to have the following percentage composition: Water 86.57, protein 1.49, albuminoids 1.02, fat 0.32, nitrogen-free extract 6.09, ash 1.78.

Breakfast foods, E. B. VOORHEES and J. P. STREET (*New Jersey Stas. Rpt. 1897, pp. 80–98*).—The authors studied a number of cereal foods generally classed as breakfast foods. These included 21 samples of prepared wheat flour, 12 of prepared buckwheat flour, 30 wheat foods, 17 oat foods, 7 maize foods, 3 rice products, and 3 sorts of zwieback. Four ordinary wheat flours and 3 buckwheat flours were also examined for purposes of comparison. The samples were purchased in open market.

The results of analyses of the different preparations, with the price per pound, are summarized in the following table:

Cost and composition of breakfast foods.

	Selling price per pound.	Water.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.
	Cents.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Prepared wheat flour (average of 21 samples)	5.6	10.70	10.47	1.21	72.32	....	5.32
Ordinary wheat flour (average of 3 samples)	3.2	11.78	11.79	1.11	74.90	....	.42
Prepared buckwheat flour (average of 12 samples)	5.1	11.45	8.61	1.26	73.07	....	5.67
Ordinary buckwheat flour (average of 3 samples)	3.0	12.91	5.19	.90	80.19	....	.81
Wheat foods:							
Parched farinose (average of 2 samples)	7.6	7.64	14.98	3.45	71.79	.77	1.37
Granose flakes (average of 3 samples)	23.0	8.08	14.49	1.39	71.83	1.69	2.52
Jackson's granula	16.6	8.97	12.50	1.44	73.77	1.55	1.77
Wheat-germ meal	7.9	12.28	13.41	2.50	69.23	1.21	1.37
Wheatena (average of 3 samples)	11.8	6.60	14.53	3.50	73.21	.87	1.29
Ralston's health wheat food	8.0	11.77	14.87	1.80	70.00	.48	1.08
Wheatlet (average of 3 samples)	7.8	10.77	12.46	2.12	72.96	.81	.89
Cream of wheat (average of 2 samples)	9.1	10.47	12.47	.91	75.77	.11	.29
Farina (average of 4 samples)	10.3	12.71	11.07	.94	74.74	.17	.37
Shredded whole wheat (average of 3 samples)	15.6	8.04	10.62	1.37	77.01	1.48	1.73
Leggett's cracked white wheat	7.5	10.04	12.84	1.78	72.52	1.23	1.59
Pettijohn's California breakfast food (average of 3 samples)	6.3	9.87	9.97	2.12	75.31	1.72	1.46
Germea (average of 3 samples)	8.2	9.71	9.13	1.75	77.79	.76	.87
Oat foods (average of 17 samples)	6.4	7.94	16.72	7.65	65.38	.81	1.61
Maize foods:							
Cerealine flakes (average of 3 samples)	11.8	10.33	9.75	1.11	78.56	.27	.28
Hominy (average of 4 samples)	4.8	10.98	8.74	.76	79.01	.26	.26
Rice foods:							
Cook's flaked rice (average of 2 samples)	13.4	9.50	7.90	.41	81.68	.17	.35
Rice in bulk (first quality)	8.0	11.95	7.41	.33	79.96	.12	.23
Anger's zwieback (average of 2 samples)	20.1	5.15	8.64	11.14	74.03	.17	.88
Sanitary zwieback	31.1	5.21	11.71	8.09	73.94	.10	.95

The prepared flours, commonly called pancake flours, and the oat preparations, though possessing different trade names, varied so little in composition that only the average results of each are quoted. The following oat foods, ranging in price per pound from 4 to 7.7 cts., are included in the average given in the table: Pin Head Oat Meal, Rolled Avena, Aunt Abbey's Rolled Cooked Oats, Cormack's Nudavene Flakes, Dundee Brand Oat Meal, Hecker's Oat Meal, Hornby's Oat Meal, Leggett's 15-Minute Oat Flakes, Martha Washington Rolled White, Oven-Baked Breakfast Rolled, and Quaker Rolled White Oats.

"All of the oat products, as well as a number of the wheat, contain considerable amounts of crude fiber—this constituent having been determined in nearly every case in order to show how fully the claims made in reference to the removal of the hull or covering, or woody matter, were verified. In one case it was claimed that the fiber had been entirely removed; this is not verified by the analysis. . . .

"[A study of similar products put on the market by different makers shows that] the variations in their composition are not marked, and that such as do occur are probably due to the variations in the composition of the original wheat. In the oat products the protein is the constituent that shows the widest variation, while in the corn and rice products the chief variable constituent is water. In the different samples of prepared flour wide variations occur in composition, doubtless due both to variations in the composition of the original flour and to the varying amounts and different character of the leavening materials added. In the wheat flours the widest range occurs in the content of protein. . . .

"In the case of the prepared flours, the chief object is to save the time of the housekeeper in their preparation for the table. The difference in composition between the plain flour and the prepared products is chiefly in the proportion of the constituents caused by the addition of leavening material. . . .

"Even assuming that the composition had not been altered in other respects, i. e., the food value has not been reduced, the addition of 5 per cent of mineral matter has caused an increase of 75 per cent in the cost per pound of the product."

In all the different classes the price for practically the same kind of preparation was found to vary within wide limits. In some cases the high price was perhaps due to some special method of preparation. The claims made for many of these foods were not found to be justified by their composition. "These claims, extravagant in some instances, should have but little weight with consumers, as the actual amount of nutriment furnished [by similar products] does not greatly differ."

A further study of the changes that occur in the process of baking bread, L. A. VOORHEES (*New Jersey Stas. Rpt. 1897, pp. 98–103*).—In continuation of previous work (E. S. R., 9, p. 79) a study was made of the changes which the nutrients undergo in baking bread. A number of experiments are reported in which the bread and the ingredients from which it was made were analyzed. Baking powder was used for leavening and milk was added as a source of fat. In several instances a flour was used which had been previously extracted with ether.

The dry matter was almost entirely recovered in the bread but this was not the case with the fat. The fuel value of the bread was about the same as that of the ingredients from which it was made. A loss of fat was also observed when the flour was made into dough and carefully dried without baking.

In the author's opinion the loss of fat is accounted for by the fact that the gluten hinders the solvent action of the ether. The work is not regarded as final.

Digestion and feeding experiments, W. H. JORDAN and C. G. JENTER (*New York State Sta. Bul. 141, pp. 691–720*).—Experiments are reported on the digestibility of a material prepared like the so-called "new corn product," on the agreement between the calculated value of a ration and its value as shown by actual experiment, and the relative nutritive effect of rations from unlike sources.

The new corn product (pp. 693–701).—This material, also known as Marsden's Stock Food, is a by-product obtained in the manufacture of cellulose from the pith of cornstalks for packing the hulls of ships (E. S. R., 9, p. 76). For the experiments about 200 lbs. of well-cured corn stover was divided into bundles, the leaves and husks stripped from one-half of each bundle, and the pith removed from the stalks. The leaves and husks formed 65.2 per cent of the total weight, the stalks minus the pith 24.5 per cent, and the pith 10.3 per cent. The stalks without the pith were ground to a coarse meal, which was said to be not quite as fine as the "new corn product." The composition of the different parts was found to be as follows:

Composition of corn stover and pith.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Whole stover	19.81	5.22	3.19	53.46	32.45	5.68
Stover without pith	12.21	5.24	3.09	53.93	32.52	5.22
Pith	13.27	3.48	5.62	52.77	33.61	4.52

"The pith, instead of being nearly pure cellulose, is at least two-thirds something else, and there is no reason for supposing that the pith of other lots of maize would be essentially unlike this sample."

A somewhat detailed study was made of the ether extract of the different materials. It was found that corn stover contained 0.82 per cent of carbohydrates soluble in water and 0.21 per cent soluble in malt extract, while the stover without the pith contained 0.61 and 0.29 per cent, and the pith 1.37 and 0.11 per cent, respectively. That is, the proportion of sucrose, starches, and other carbohydrates does not vary greatly in the 3 materials.

Digestion experiments of 8 days' duration (the first 3 days being preliminary) were made with 4 wethers. In one period the 4 sheep were each fed the same amount of corn stover per day, and in another period 3 of the sheep were fed the same amount of corn stover without the pith. The experiments were made by the usual methods. The results are shown in the following table:

Coefficients of digestibility of corn stover with and without the pith.

	Dry matter.	Organic substance.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
Whole stover:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sheep 1	53.9	56.7	10.7	69.0	56.5	63.2	7.7
Sheep 2	54.6	58.1	17.1	77.4	57.6	63.5	....
Sheep 3	52.7	56.3	16.7	74.2	54.5	63.8	....
Sheep 4	52.9	55.8	22.0	76.3	58.8	66.9	5.1
Average of 4 sheep	53.5	56.7	16.6	76.2	56.8	64.3	....
Stover without pith:							
Sheep 1	53.6	55.3	16.5	69.8	55.7	59.6	21.8
Sheep 3	55.1	57.2	28.1	75.3	55.5	63.1	15.6
Sheep 4	56.7	59.0	16.9	70.9	58.5	65.5	14.7
Average of 3 sheep	55.1	57.2	20.5	72.0	56.6	62.7	....

"We do not have here any evidence that the removal of the pith of the maize plant materially increases the food value of the remaining portion. One sheep digested more from the stover containing the pith and 2 digested less, the average being not greatly different in the 2 cases.

"The real test of the digestibility of a feeding stuff is the digestibility of the organic matter, because in the case of such materials as corn stover the accidental mineral matter is a modifying factor. One-half of 1 per cent more of organic matter was digested from the stover without pith than from that with pith, a difference so small as to be well within the limits of error of such work."

The results are compared with those obtained at the Maryland Station (E. S. R., 9, p. 76; 10, p. 75).

Calculation of the value of rations (pp. 701–712).—Experiments were made with 4 sheep to compare the digestibility of mixtures of unlike materials furnishing practically like amounts of nutrients, and to compare the digestibility of the same rations when fed in large and small amounts. There were 2 periods of 5 days each. The rations were as follows:

Constituents and amounts of rations.

	Period 1.		Period 2.	
	Full ration No. 1. Sheep 1 and 2.	Half ration No. 2. Sheep 3 and 4.	Full ration No. 2. Sheep 1 and 2.	Half ration No. 1. Sheep 3 and 4.
	Grams.	*Grams.*	*Grams.*	*Grams.*
Timothy hay	100	150	300	50
Corn silage	800	250	500	400
Oats, ground	100	....	....	50
Peas, ground	120	....	....	60
Malt sprouts	....	20	40	....
Brewers' grains	....	30	60	....
Buffalo gluten feed	....	30	60	....

The coefficients of digestibility are given in the following table:

Coefficients of digestibility of mixed rations by sheep.

Period.		Dry matter.	Organic substance.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
1	Full ration No. 1:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
	Sheep 1	69.5	71.8	70.7	79.3	75.7	59.0	13.1
	Sheep 2	69.3	71.7	71.0	81.8	75.2	58.9	13.8
	Average	69.4	71.7	70.8	80.5	75.4	59.0	13.4
	Half ration No. 2:							
	Sheep 3	66.9	68.7	69.8	76.5	69.5	64.8	27.6
	Sheep 4	65.1	67.4	71.7	75.7	69.0	59.9	15.5
	Average	66.0	68.0	70.7	76.1	69.2	62.3	21.5
2	Full ration No. 2:							
	Sheep 1	62.2	64.7	69.7	73.9	65.2	59.0	9.7
	Sheep 2	61.1	63.8	60.9	73.8	64.9	61.1	4.1
	Average	61.6	64.2	65.3	73.8	65.0	60.0	7.9
	Half ration No. 1:							
	Sheep 3	75.7	77.2	76.0	82.1	79.4	70.3	40.6
	Sheep 4	73.1	75.4	75.2	82.2	78.6	64.2	20.8
	Average	74.4	76.4	75.6	82.1	79.0	67.2	30.7

Since the results show that the half rations had higher coefficients of digestibility than the whole rations, the conclusion is drawn that when consumed in small amounts feeding stuffs are more digestible than when consumed in large amounts.

Using the coefficients of digestibility obtained above, the authors calculated the amounts of digestible nutrients in 2 mixed rations like those fed, except larger, and compared the results with those calculated from average tables of composition and digestibility, as follows:

Digestible nutrients in the two rations as calculated and as actually determined.

	Calculated from averages.				Determined.			
	Organic matter.	Protein.	Carbohydrates.	Fat.	Organic matter.	Protein.	Carbohydrates.	Fat.
	Lbs.	*Lbs.*	*Lbs.*	*Lb.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Ration 1: Timothy hay 5 lbs., corn silage 40 lbs., ground oats 5 lbs., ground peas 6 lbs	16.1	2.21	13.31	0.57	16.0	2.14	12.89	0.99
Ration 2: Timothy hay 15 lbs., corn silage 25 lbs., malt sprouts 2 lbs., brewers' grains 3 lbs., Buffalo gluten feed 3 lbs	16.2	2.24	13.1	.83	16.22	2.25	12.96	1.01

Since the results agree so nearly, the conclusion is drawn that when the value of rations is calculated by the ordinary tables of composition and digestibility the actual value of the rations is shown.

The relative nutritive effect of rations from unlike sources (pp. 712–720).—In the rations mentioned above the total amounts of nutrients as expressed in terms of protein, fat, and carbohydrates are about the same, yet it does not follow that the rations have the same actual feeding value, since the nutrients in different feeding stuffs are present in different forms. The authors determined the relative amounts of the different carbohydrates in the nitrogen-free extract of the various feeding stuffs used, assuming all the carbohydrates soluble in malt extract to be starch and sugar. The results follow:

Composition of carbohydrates in feeding stuffs.

	In water-free materials.			Proportion of nitrogen-free extract not starch and sugar.
	Total nitrogen-free extract.	Nitrogen-free extract soluble in malt extract.	Nitrogen-free extract insoluble in malt extract.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Timothy hay	51.9	15.7	36.2	70.0
Corn silage	55.3	26.4	28.9	52.3
Oats	65.3	50.3	15.	23.0
Peas	63.5	53.9	9.6	15.1
Malt sprouts	49.2	22.9	26.3	55.5
Brewers' grains	43.8	12.9	30.9	70.5
Buffalo gluten feed	59.0	37.1	21.9	37.1

Using the above values, it is calculated that ration 1 furnished 8.21 lbs. of starch and sugar, 5.33 lbs. of other nitrogen-free extract, and 4.52 lbs. of fiber; and ration 2 furnished 5.43 lbs. of starch and sugar, 8.48 lbs. of other nitrogen-free extract, and 6.53 lbs. of fiber. Assuming that all the sugar and starch in both rations was digestible, it is calculated that ration 1 contained 1.99 lbs. of digestible nitrogen-free extract other than starch and sugar, and 2.67 lbs. of digestible fiber, and ration 2, 3.61 lbs. and 3.92 lbs., respectively.

"From a theoretical point of view, when we consider that the pentose sugars formed may be less assimilable than the hexose, and that cellulose digestion may in part be due to destructive fermentations, it is reasonable to admit the possibility of unlike nutritive values for a unit of digestible material from these two sources; but the demonstration of this fact, if it be a fact, is a difficult matter. A large difference in the value of two rations may be shown, perhaps by ordinary feeding trials, but small differences may be obscured by the errors to which such experiments are subjected."

An experiment was conducted with 2 lots of 5 milch cows to learn "whether the milk-producing capacity of a ration is modified by the sources of the digestible compounds, other conditions being uniform."

Some of the animals were in the early stages of lactation, but "none were so far advanced as to endanger the reliability of the data." After a preliminary experiment of 5 days the test, which covered 2 periods of 30 and 33 days, respectively, was begun March 2. During the first period lot 1 was fed ration 1 mentioned above, and lot 2 was fed ration 2. In the second period the rations were reversed.

The amounts of food eaten and the yield of milk and milk solids for each cow during each period are recorded. On ration 1 the cows consumed on an average per day 15.26 lbs. of digestible matter and produced 2.74 lbs. of milk solids, and on ration 2, they consumed 14.8 lbs. of digestible matter and produced 2.73 lbs. of milk solids.

"The results furnish no testimony in favor of the superior quality of ration No. 1, i. e.—in favor of the ration containing the larger proportion of easily digestible carbohydrates that belong to the hexose group. . . .

"If a certain class of carbohydrate compounds possesses a superior nutritive value, the fact must be brought to light through some method of investigation more searching than feeding experiments of this character.

"It is certainly shown that in one case at least the commercial feeding stuffs of the by-product class were successfully substituted for such grains of high quality as oats and peas.

"Moreover, a much larger percentage of the digestible dry matter of the ration was supplied in timothy hay and silage in the first ration than in the second ration, the proportion being about 70 : 55 in the 2 cases, but as has been stated no evidence appeared that the second ration was inferior to the other. Such an outcome is encouraging to those farmers who wish to avoid the purchase of cattle foods by feeding largely home-grown fodders and purchasing sparingly such grains as are best calculated to supplement hay and silage."

Agricultural feeding stuffs, their feeding value and use, together with directions for preparing rations for farm animals, E. HASELHOFF (*Die landwirtschaftlichen Futtermittel, ihr Futterwert und ihre Verwendung, nebst Anleitung zur Aufstellung von Futterrationen für die landwirtschaftlichen Nutztiere. Neudamm: J. Neumann, 1898, pp. 173*).—Preface by O. König.

Market prices of commercial feeds, E. B. VOORHEES and J. P. STREET (*New Jersey Stas. Rpt. 1897, pp. 78, 79*).—The market prices during the past few years of a number of commercial feeding stuffs are reported.

The amount of nonproteid nitrogen in straw and chaff of various sorts, P. HOLDEFLEISS (*Ueber den Gehalt der reifen Stroh- und Spreuarten an nichteiweissartigen stickstoffhaltigen Stoffen. Inaug. Address. Halle: C. A. Kämmerer & Co., 1897; abs. in Centbl. Agr. Chem., 27 (1898), No. 8, pp. 532–534*).—The author reports the determination of the total protein (by the Kjeldahl method) and the albuminoid nitrogen (by the Stutzer method) in a large number of varieties of straw, hulls, etc. The results are arranged in tabular form.

Problems in feeding, T. L. HAECKER (*Indiana State Dairy Assoc. Rpt. 1897, pp. 137–143*).—General remarks on the relative value of different feeding stuffs.

Some results in stock feeding, F. H. HALL (*New York State Sta. Bul. 141, popular ed., pp. 6*).—This is a popular edition of Bulletin 141 of the station (see p. 471).

Summary of the investigations on the nutrition of man and animals carried on in the United States during the last two years, E. GAIN (*Assoc. Française Advancement Sci., Congrès Saint-Étienne, 1897, pp. 820–833*).—The author notes, in many cases with some detail, the principal recent publications on the food of man and animals issued in the United States. In most cases the articles cited were publications of the United States Department of Agriculture or of the Agricultural Colleges and Experiment Stations.

Bread (*Diet. and Hyg. Gaz., 14 (1898), No. 9, p. 580*).—A brief note calling attention to the fact that the handling of bread by bakers and their assistants is a menace to health. In Berlin agitation on this subject has resulted in placing the loaves as taken from the oven in paper bags, the ends of which are twisted.

Wheaten bread, TISON (*Le pain de froment. Paris: A. Maloine, 1898; rev. in British Med. Jour., 1898, No. 1973, p. 1262*).—The author believes that the bran should be rejected in grinding wheat, but that improvements in grinding should be sought, as the present method rejects too much. Steel grinders are recommended. The tegument and pericarp are not regarded as digestible by man and whole-wheat bread is condemned on the basis of hygiene and economy.

The medicinal value of fruit as food, C. T. SAUER (*Amer. Gard., 19 (1898), No. 189, pp. 558, 559*).—The composition and properties of a number of fruits are discussed. The author is of the opinion that fruits do not possess any great medicinal value, but are to be regarded as food adjuncts, their chief virtue as medicines consisting in furnishing the blood with potash salts.

Potato flour in Austria, F. W. MAHAN (*U. S. Consular Rpts. 1898, No. 216, pp. 68, 69*).—Potato flour, also known as potato starch, which is used to a considerable extent by bakers and confectioners, is described and an analysis quoted.

Nutritive value of mushrooms (*Diet. and Hyg. Gaz., 14 (1898), No. 8, pp. 487, 488*).—Attention is called to the small amount of actual nutrients in mushrooms, and extracts from early works are quoted which show that this fact has been long recognized.

The need of meat inspection (*Diet. and Hyg. Gaz., 14 (1898), No. 8, pp. 497–499*).—The article quoted from L. Pierson in *Public Health* describes the conditions under which animals are slaughtered in Philadelphia and insists upon the need of some more adequate system of meat inspection, the municipal abattoir being recommended.

Composition of meat peptones, A. DENAEYER (*Jour. Pharm. et Chim., 6. ser., 6 (1897), p. 357; abs. in Vrtljschr. Chem. Nahr. u. Genussmtl., 12 (1897), No. 4, p. 491*).

The composition of fish, crustaceans, and mollusks, BALLAND (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 24, pp. 1728–1731*).—The composition of a considerable number of fish, crustaceans, and mollusks sold in Paris is reported.

On the formation of products of proteid digestion in the body, their identification, and fate, A. MEYER (*Ueber den Nachweis und die Entstehung der Produkte der Eiweissverdauung sowie über ihr Schicksal im Organismus. Inaug. Diss., Heidelberg, 1898, pp. 41; abs. in Hyg. Rundschau 8 (1898), No. 8, p. 392*).

The influence of consuming different quantities of water on the excretion of water vapor and carbon dioxid by man, P. LASCHTSCHENKO (*Arch. Hyg., 33 (1898), No. 1–2, pp. 145–150*).—In experiments with man the amount of carbon dioxid and water vapor excreted through the lungs was not materially affected by the amount of water consumed.

Note on the excretion of water vapor through the lungs, M. RUBNER (*Arch. Hyg., 33 (1898), No. 1–2, pp. 151–154*).—The author found in experiments with man that less water vapor was excreted through the lungs when reading aloud than when singing; still less was excreted when deep breathing was practiced, and least of all when the subject remained perfectly quiet.

Feeding of calves with potato flour and skimmed milk, J. SCHULTZ (*Landmansblade, 31 (1898), No. 22, pp. 302, 303*).

Feeding experiments with swine, P. HANSSON (*Meddel. K. Landtbr. Styr., 7 (1897), No. 42, pp. 155, 156*).—A comparison of rice meal, molasses feed, and ground grain for swine.

The native breed of cattle in Gotland, G. AF WETTERSTEDT (*Landtmannen, 9 (1898), No. 25, pp. 395–397, pls. 2*).

The marketing of poultry, E. BROWN (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), Pt. II, pp. 270–286*).—Marketing poultry in England and some other countries is discussed, and suggestions made for improving this industry in England.

Drawn vs. undrawn poultry (*Diet. and Hyg. Gaz., 14 (1898), No. 8, p. 487*).—From experiments, which are briefly reported, the conclusion is reached that under "precisely the same conditions of temperature and humidity drawn fowls will keep from 20 to 30 days longer than those not drawn. The presence of undigested food and of the excrementitious substances in animals which have been killed most certainly favors tainting of the flesh and general decomposition. The viscera are the first parts to show putrescence, and allowing these to remain within the body can not do otherwise than favor infection of the flesh with bacteria and ptomains, even if osmosis does not actually carry putrid juices to contiguous tissues. Hunters know the value of drawing birds as soon as possible after they have been shot, in order to keep them sweet and fresh and to prevent their having a strong intestinal flavor.

"That the opening of the body of an animal and exposing the internal surfaces to the air may have some influence of itself in hastening putrefaction is admitted; but when the process of 'drawing' is properly conducted this secondary objection to its immediate performance may be entirely set aside. Absolute cleanliness should be maintained throughout the operation, and if the entrails are torn and their contents allowed to come in contact with the flesh of the animal its interior should be at once washed out with clean cold water and afterwards with a solution of common salt and the carcass hung up until thoroughly dry."

DAIRY FARMING—DAIRYING.

Dairy husbandry, C. B. LANE (*New Jersey Stas. Rpt. 1897, pp. 163–192, pls. 2, dgms. 1*).—This includes an abstract of Bulletin 122 of the station (E. S. R., 9, p. 790) and an account of the dairy work during two seasons. The growing of various soiling crops and other forage crops on the farm is described, with the order in which the soiling crops were planted and harvested, the amount of food nutrients which they furnished, and the cost of production.

The production of food materials during a 4-year rotation which had been carried on at the farm is shown in the following table:

Food materials produced and fertilizing materials removed in a rotation.

	Food constituents.					Fertilizing constituents.		
	Protein.	Crude fat.	Nitrogen-free extract.	Fiber.	Ash.	Nitrogen.	Phosphoric acid.	Potash
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Field corn, 1893	341.9	100.7	2,127.7	638.5	174.8	54.5	26.4	32.2
Crimson clover and fodder corn, 1894	909.3	237.6	4,962.4	108.1	439.0	145.8	44.6	87.3
Fodder, rye, and oats, and peas, 1895	569.6	170.2	2,693.6	446.1	355.1	91.1	47.1	97.4
Mixed hay and forage, 1896	300.4	74.5	1,422.9	900.8	161.8	48.2	15.6	53.1
Total	2,121.2	583.0	11,206.6	2,093.5	1,130.7	339.6	133.7	270.0
Average per year	525.0	145.0	2,801.0	523.0	282.7			

The arrangement of soiling crops in 1896 and 1897 is described and the yields in each case are given. In 1896 they furnished "a continuous supply of food from May 1 to November 1, and the produce from 7 acres will supply sufficient roughage for 25 cows for the entire period." In 1897, "with the exception of a week in June, when silage was used, the dairy herd was fed entirely upon soiling crops from May 1 to October 20." The soiling crops in both years consisted largely of leguminous crops grown alone or with oats or barley.

Notes are given on the growing of the different soiling crops and a test is reported on the comparative earliness, manner of growth, and yield of 8 standard varieties of Canada field peas. "All varieties stood up well. The crop was cut with a mowing machine while most of the peas were in bloom. The Prussian Blue proved to be the best yielder, while the Mummy, Green Field, and Green Scotch all made a vigorous growth."

The yields of milk upon the different soiling crops are tabulated. The aim was to furnish an equivalent amount of dry matter from each crop.

"The feeding of the crimson clover resulted in a gain in milk flow on the part of all the animals, the gain per day ranging from 3 to 3.5 lbs., an average per cow for the whole of 1.8 lbs., or 8 per cent. In the comparison of the crimson clover and mixed grasses there are 12 cases ranging from 0.7 to 2.2 lbs., with an average of 1.3 lbs., or over 6 per cent. The mixed grasses consisted chiefly of red and white clover and redtop. In the case of silage and mixed grasses, the silage being introduced for comparison with green forage, there was a loss [on silage] in every case varying from 0.1 to 2.8 lbs., with an average loss of 1.9, or over 7 per cent.

"In the case of silage *vs.* oats and peas, and oats and peas *vs.* peas, but little difference in the average yield per cow is noticed, though individual differences are quite marked. In the case of oats and peas *vs.* oats, and oats and peas *vs.* corn fodder, and in corn fodder *vs.* millet, there are decided losses [on silage], ranging from 3 per cent to over 7 per cent."

The cost of milk production for one year, ending April 1, 1897, is given. The herd averaged 23 cows for the year.

"The average cost of the daily ration is 11.6 cts., and of this 4.99 is due to purchased feeds and 6.61 to the cost of farm foods, so that the farm furnished 57 per cent of the total food. This is not so large a proportion as is desirable, and is due in part to the fact that there was but little roughage on hand when the station took charge of the farm, on April 1, 1896; besides, no provision had been made for early forage crops, as rye and clover, consequently a larger proportion of feeds was used during the first 3 months of the year. The cost of food per quart of milk was 1.5 cts., of which 0.646 is due to purchased feeds and 0.854 to farm crops.

"[Taking into account the cost of labor and the interest on and the decrease in the value of the herd] the cost per hundred was $1.14. At $1 per hundred, the price received in rural districts, cash profits from the business are not apparent. The profits, if any, must be found in the manure heap. In the calculation of the cost of farm foods the manure was charged at the rate of $1.50 per ton. Careful weighing of the manure deposited in the stable shows that the amount produced averaged 60 lbs. per day per cow, or a total for the herd of 252 tons per year.

"In selling for $1 per hundred, the receipts are $203.95 less than the expenses, this difference representing the cost of the manure, which would be 81 cts. per ton. The

difference between this cost (81 cts.) and the actual charges made for it in the growing of the crops, $1.50 per ton, viz, 69 cts. per ton, would amount to $173.88 on the total amount produced—a gain too small to make the business pay. . . .

"At 3 cts. per quart the farm would sell its home-grown produce to the dairy at profitable prices, viz, $2.78 for soiling crops, $5.56 for silage, and $8.34 per ton for dried corn fodder, a gain on the crops over cost of production of $1.38 per ton for soiling crops, $2.79 for silage, and $3.34 for dried corn fodder, besides an additional gain represented by the 252 tons of manure."

Dairying in relation to soil exhaustion is considered, and a table is given showing the amounts of fertilizing materials contained in the feeding stuffs purchased and in the milk produced by the herd of 23 cows. According to this the feeding stuffs purchased contained 851 lbs. more nitrogen, 640 lbs. more phosphoric acid, and 214 lbs. more potash than in the milk sold from the farm. A record of the herd is given for one year, ending April 1, 1897, and the record of individuals is considered. The record of the best and poorest cows from the standpoint of milk and butter production and the averages for the herd are summarized in the following table:

Records of best and poorest cows for milk and butter production.

	Animal yield.	Value of product.			Cost of feed.	Gain over cost of feed with—		
		Milk at 1 ct. per lb.	Milk at 3 cts. per quart.	Butter at 20 cts. per lb.		Milk at 1 ct. per lb.	Milk at 3 cts. per quart.	Butter at 20 cts. per lb.
Milk production:	*Pounds.*							
Best cow	8,303	$83.03	$114.26	....	$42.34	$40.69	$71.92	....
Poorest cow	4,413	44.13	60.74	....	42.34	1.79	18.40	....
Average cow	6,314	63.14	86.89	....	42.34	20.80	44.55	....
Butter production: *a*								
Best cow	405	....	....	$81.08	42.34	....	....	$38.74
Poorest cow	202	....	....	40.43	42.34	....	....	—1.91
Average cow	313	....	....	62.70	42.34	....	....	20.36

a Calculated.

"The range in percentage of butter fat was from 2.8 per cent to 6.4 per cent, with an average of nearly 4.3 per cent.

"The best milk cow was the second butter cow; the best butter cow was the fifth in order in largest milk yield."

The claim that for profitable milk production a cow should produce at least 5,000 lbs. of milk per year, and for profitable butter production at least 200 lbs. of butter, appears to be supported by the year's record.

The milk of the herd is sold on the milk route. The method used in handling the milk, care of utensils, and waste in handling and delivering are discussed, and a brief description is given of the new dairy house.

An article on seeding grass and crimson clover is noted elsewhere (p. 431).

Milk production with salt-marsh hays, J. B. LINDSEY and B. K. JONES (*Massachusetts Hatch Sta. Bul. 50, pp. 19–48*).—Experiments are reported with 2 lots of 6 cows each in which 6 different salt-marsh hays

(see p. 472) were compared with common hay ("English hay"). A constant basal ration of wheat bran, Chicago gluten meal, and corn silage was fed, and in addition to this 10 to 12 lbs. of salt or English hay was fed. About 1 lb. more of salt hay was fed than of common hay, as the former contained from 6 to 8 per cent more water. The periods lasted from 14 to 17 days, with preliminary periods of 5 or 7 days intervening. The results are tabulated in detail, and analyses are given of the feeding stuffs used and of the milk of individual cows.

A summary of the results, with the averages for the salt hays and for English hay, is shown in the following table:

Summary of results of feeding salt-marsh hays to cows.

Periods.	Basal ration and	Average amount fed per cow.	Dry matter in ration.	Digestible protein in ration.	Average yield of—		Average cost of—		Total gain (+) or loss (—) in weight.
					Milk.	Butter. *a*	Milk per quart.	Butter per pound.	
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cents.*	*Cents.*	*Lbs.*
1	Black-grass hay	12.77	22.23	2.22	19.50	1.11	1.84	15.00	— 28
	English hay	11.83	21.90	2.14	20.40	1.18	2.22	18.00	+ 18
2	Fox-grass hay	12.50	23.40	2.39	24.80	1.16	1.54	15.26	+ 25
	English hay	11.60	23.10	2.26	25.20	1.21	1.87	18.08	+ 39
3	Branch grass	10.33	21.26	2.05	24.70	1.16	1.45	14.50	— 10
	English hay	9.33	21.36	2.05	26.00	1.13	1.64	16.12	+ 44
4	Redtop variety	11.00	21.95	2.05	15.90	1.00	2.23	16.50	+ 13
	English hay	10.00	21.27	2.16	17.46	1.07	2.46	18.60	+ 13
5	Cove mixture	11.17	24.60	2.13	18.71	1.08	1.91	15.40	+ 14
	English hay	10.17	21.42	2.09	19.35	1.07	2.23	18.60	+ 55
6	Salt-hay mixture	10.75	22.09	2.01	23.00	1.17	1.58	14.45	- 4
	English hay	9.75	21.75	2.16	23.40	1.21	1.86	16.86	— 9
	Average for salt hays *b*	11.50	22.12	2.16	*c*11,361	*c*499.6	1.66	15.00	-13
	Average for English hay	10.54	21.91	2.14	*c*11,778	*c*521.8	1.96	17.53	+ 47

a Calculated from yield of fat in milk.
b "Excluding redtop variety, which is not, strictly speaking, a salt hay."
c Total, instead of average.

The cost of milk and butter production is based on the following prices of feeding stuffs: English hay \$18, salt-marsh hay \$10, corn silage \$3.50, wheat bran \$15, and Chicago gluten meal \$20 per ton.

"The salt-hay rations produced from 2 to 5 per cent less milk and butter than did an equal amount of English hay similarly combined. The variety of redtop was the only exception to this; it yielded 9 per cent less milk and butter. . . .

"The salt-hay rations produced milk with a trifle less percentage of fat than did the English hay rations. The difference is so slight as to be of no practical importance.

"Because of the lower market price for salt hays, as compared with English hay, daily rations containing 10 to 12 lbs. of salt hay produced milk and butter from 10 to 20 per cent cheaper than rations containing an equal amount of English hay."

Samples of butter made on English hay, black-grass hay, and fox-grass hay, respectively, were submitted to experts for scoring; and samples of the milk produced on these hays were submitted to different parties.

"These experiments make clear that the salt hays, when constituting from 30 to 40 per cent of the daily ration, did not impart any objectionable odor or flavor to the milk or butter. Flat sage is known to have a somewhat stronger flavor, and had that been fed, it is possible that the results might have been somewhat different."

The effects of food on milk and butter, J. SPEIR (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 296–338*).—This work, carried on at Newton Farm, Glasgow, was in continuation of experiments[1] made in 1895–96, "which seemed to indicate that two foods, viz, decorticated cotton-seed cake and vetches, had some tendency to increase the fat in the milk, while fresh young grass and grains had a tendency to decrease it. These experiments also plainly indicated that while many foods appeared to have a tendency to enrich or impoverish the milk, still neither effect seemed permanent, the inclination after a time being for the milk to return to more normal conditions."

The present studies were made with 8 cows and covered 12 periods, usually of about 5 weeks each. A large number of feeding stuffs of different kinds were tested in various combinations. The milk was weighed and tested for fat, and was also skimmed with a hand separator and the cream churned and made into butter to observe the effects of the different foods on the production of butter. The general quality of the butter, its melting point, flavor, and keeping quality were also determined. The results are tabulated for each period, together with the results of the previous experiments.

"Rations having an extremely high albuminoid ratio seem to have a depressing effect on the milk yield, well-mixed foods giving the best results in this respect. Every food, when first given, seems to have more or less effect in increasing or decreasing the percentage of fat in the milk. This effect is, however, transitory, and the milk returns to its normal composition about the end of the fifth week. [Brewers'] grains in the wet state and in excessive quantity may be an exception to this general statement.

"Provided extremes are avoided, the dry matter in the food seems to be the principal controlling factor in the production of milk or increase of live weight, and is of greater importance than the albuminoid ratio.

"The fat in the buttermilk is considerably influenced by the food used; but where the cream was churned at the proper temperature, the churnability of the milk appeared to be less affected by food than the experiments of 1895 seemed to indicate. All other things being equal, each food or combination of foods seems to produce a milk which necessitates the cream from it to be churned at a temperature peculiar to itself if the best results are to be obtained.

"Soft butters usually contain a proportion of water greater than the average, and if the softness is caused by the foods used the excess of water can not be reduced by the ordinary methods of manipulation. Food exerts a very great influence on the melting point (firmness) of butter. . . .

"If first-class butter is the object, linseed cake, grains (wet or dry), Paisley meal, and foods containing a large proportion of sugar, should be discarded or reduced to the lowest limits possible.

"The principal concentrated foods experimented with having a beneficial effect on the butter are oats, decorticated cotton cake, beans, and peas."

Feeding fat in the form of an emulsion to milch cows, S. RHODIN (*K. Landt. Akad. Handl., 37 (1898), No. 1, pp. 25–33*).—Three experiments with 2 cows were made for the purpose of ascertaining the effect of feeding fat to milch cows in the form of an emulsion. Linseed

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[1] Trans. Highland and Agr. Soc. Scotland, 5. ser., 8 (1896), pp. 269–315).

oil was emulsified in a machine constructed for this special purpose. The fat globules of the emulsion had an average diameter of about 0.0011 mm. and did not separate out on being kept in a closed vessel for 10 months. The oil emulsion was given as a drink in water during 7-day periods, the quantities of oil fed during the different periods ranging from 250 to 750 gm. per day. The rations fed were normal mixed rations, with a nutritive ratio of about 1 : 5.7. No changes were made in the feed during the different experiments. Experiments 1 (lasting from December 13 to January 16) and 2 (lasting from February 5 to 25) were made with a cow of Strömsholm breed, and experiment 3 (lasting from March 22 to April 11) with a crossbred Ayrshire cow. The main results of the experiments are shown in the table given below:

Results of feeding oil emulsions to milch cows.

Period.	Drinks given in form of—	Experiment 1.				Experiment 2.				Experiment 3.		
		Milk yield.	Fat in milk. Per cent.	Fat in milk. Amount.	Water in milk.	Milk yield.	Fat in milk. Per cent.	Fat in milk. Amount.	Water in milk.	Milk yield.	Fat in milk. Per cent.	Fat in milk. Amount.
		Kg.		*Gm.*	*Per ct.*	*Kg.*		*Gm.*	*Per ct.*	*Kg.*		*Gm.*
1	Water	13.72	3.50	480.6	86.95	9.02	3.68	332.3	86.99	17.33	3.04	527.5
2	Oil emulsion in water	13.12	3.78	495.8	86.82	8.89	3.99	354.8	86.73	17.19	3.24	556.8
3	Do	13.44	3.27	440.0	87.26	9.16	3.63	332.5	86.78	16.33	2.96	482.8
4	Water	13.45	2.75	369.5	87.78	......	......	......	......	......	......	......
5	Do	13.76	3.11	428.0	87.42	......	......	......	......	......	......	......

The results of the experiments are, briefly stated, that the fat content of the milk was increased at first by feeding large quantities of oil in the form of an emulsion, but later on no increase took place; the milk, on the contrary, dropped to its previous normal fat content, depending on the individuality of the cow.—F. W. WOLL.

Feeding skim milk according to the Trystorp method, P. HANSSON (*Meddel. K. Landtbr. Styr., 1897, No. 42, pp. 150–155*).—In feeding skim milk to cows by this method, it is curdled and straw chaff added to the curdled mass (E. S. R., 8, p. 248; 10, p. 382). Instead of adding 75 per cent of chaff, as recommended by the originator of the practice, the author used only 25 per cent. As the result of a feeding experiment with 26 cows, separated into 2 even lots of 13 each, the value of the skim milk was found to be somewhat less than indicated by its content of nutrients, viz, 13 cts. per 100 lbs., against $1.18 per 100 "food units" of the mixed ration fed. In place of 1.4 lbs. of grain 8.8 lbs. of skim milk was introduced in the ration. The cows did not keep up as well in milk yield or in live weight on the skim-milk ration as they did on the mixed-grain feed.—F. W. WOLL.

Skim-milk feed for milch cows, L. F. NILSON (*K. Landt. Akad. Handl., 37 (1898), No. 2, pp. 115–122*).—A feeding experiment was made with 30 cows to test the merits of the Lindström method of feeding

clabbered skim milk to cows (E. S. R., 8, p. 248). The results of the experiment showed that skim milk fed in this manner was worth not quite one-sixth as much as grain feeds, or less than one-third of what practical experiments seemed to indicate as its value. Valuing 100 kg. of grain feed at $2.43 (according to Swedish prices), the feeding value of 100 kg. of skim milk was found to be 36.5 cts. This is a somewhat lower relative feeding value for skim milk than was found by Fjord in his early feeding experiments (E. S. R., 5, p. 428), a fact easily explained by the loss of nutrients incident to the preparation of the clabbered milk.—F. W. WOLL.

Spaying cows, J. VENNERHOLM (*Landtmannen, 9 (1898), No. 23, pp. 363–368*).—A general discussion of the subject, with an account of the results of spaying 80 cows at 2 Swedish estates. Four cows had to be killed on account of bleeding, inflammation, etc. Six months after the operation the live weights of the remaining 55 cows had increased from 22,023 kg. before the spaying to 25,111 kg. after, or an average of 156.5 lbs. per head. The milk yield was 532 liters per day before spaying and 507 liters after spaying, or a decrease of about 5 per cent during a little more than half a year.

The writer does not advocate the adoption of this practice on a large scale for healthy animals on account of the possible loss of cows, the small differences in the price of the beef, and finally the uncertainty of increasing or prolonging the lactation of the cows to any appreciable extent.

The paper is further discussed in the same journal (No. 29, pp. 474–476) by R. Arfwedson and the writer.—F. W. WOLL.

The milk supply of Boston and other New England cities, G. M. WHITAKER (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 20, pp. 37, pls. 2, map 1*).—This is an interesting and instructive bulletin on the sources and handling of the milk of several of the larger New England cities, Boston especially. The population of what is termed Greater Boston is given as over 948,000. Three-fourths of the milk supply of this territory is brought in by railroad. A map is given showing the sources of the milk supply of this territory.

"The longest direct run is 140 miles, and some railroad milk comes only 20 miles. Most of this milk is conveyed in cars built for this especial purpose, with refrigerator closets for the cans of milk and with provision for steam heat. . . . Most of the cars start in the morning, from 4 to 6 o'clock, and reach the city between 10 and 11. In a few instances the car starts the afternoon previous, and is on the road over night, reaching Boston during the next forenoon. The cars, in the summer, frequently take the milk of the same morning; some start too early for the milk of that morning, especially in the winter, and hence bring the milk of the previous day. Milk is therefore 18 to 30 hours old before reaching the city. The number of these milk cars averages about 35, although varying somewhat with the season.

"By filling passageways and other open spaces as many as 1,200 cans (10,200 qt.), or over 10 tons in weight, can be got into a car. Railroad officials consider 10 tons a carload. The nominal load, however, is 900 cans (7,650 qt.)."

In the historical discussion it is stated that "Boston seems to have been the pioneer city of the United States in the transportation of milk by railroad," the beginning having been made in April, 1838.

"To-day the business of transporting milk to the city by railroad is done by 7 concerns. Six of these 7 milk wholesaling houses have an association for bringing about uniformity in methods of doing business and for mutual self-protection. To-day fully three-quarters of the milk supply of Greater Boston passes through the hands of these large wholesalers, locally known as 'contractors.' . . .

"All of the contractors have cheese or butter factories in the city or country, or both, for the manufacture of butter and cheese."

The arrangements between the milk producers and the contractors are described, and also the Milk Producers' Union, which is an organization of the farmers who sell milk to the contractors. This union deals with the Milk Contractors' Association in fixing the schedule of prices and other regulations, and has tended to promote uniformity and business-like methods and to keep the price of milk quite steady. The summer and winter prices for 12 years are given, showing remarkably little variation. The average "theoretical Boston price per can of $8\frac{1}{2}$ qt." for 12 years has been $32\frac{1}{4}$ cts. during summer and $36\frac{3}{5}$ cts. during winter. From this "theoretical" price a deduction is made for transportation on a fixed schedule agreed to by the Milk Producers' Union, depending upon the distance. There is also a deduction made for the surplus milk, which is made into butter, and for which only the "butter value" of the milk for the month is paid. This, together with "grading" the price in different months to prevent too large a surplus, is a cause of much friction between the producers and the contractors, as the application of the system is blind to many farmers. But the system of buying all the milk that is offered furnishes shippers a market for all they can produce and does away with the former inconvenience arising from the irregularity of the amount taken by the contractors.

"The cans are returned to the farmers unwashed and sometimes in a very filthy condition," which has gone so far as to result in several attempts on the part of the farmers to invoke legislation compelling the contractors to wash the cans.

Of the other one-fourth of the milk supply a portion comes in by railroad and the remainder is produced within the limits of Greater Boston or in territory nearby. "Over 7,000 cows are kept in Greater Boston."

The milk supply of Providence, the second city in size in New England, is nearly all produced within 20 miles of the city. About 75,000 qt. per day, or 27,375,000 qt. per year, is used.

"The selling of milk from stores is more prevalent than in many other cities of New England. It is estimated that almost half of the milk consumed in this city is sold from stores instead of being delivered from house to house by peddlers. . . . Milk is from 12 to 48 hours old when it reaches the consumers in Providence."

The supplies of several other cities are briefly noted, although for the most part they present no novel features.

The cream trade, which has largely increased of late, is described, together with the sale of skim milk, buttermilk, condensed milk, etc. The rather surprising statement is made that although a great deal of surplus milk is made into butter after it reaches Boston, furnishing quite a large supply of skim milk, the greater part of it is allowed to run into the sewers, as there is no market for it.

The milk laws and inspection are discussed, together with a consideration of the quality of milk sold in different cities.

"All of the States have laws relative to the healthfulness of the milk supply. Massachusetts, Maine, Rhode Island, and New Hampshire prohibit the sale of milk from sick or diseased cows or cows fed upon the refuse of breweries or distilleries or upon any substance deleterious to its quality. Connecticut prohibits the sale of 'impure milk' and milk from cows which shall have been adjudged by the commission upon diseases of domestic animals to be affected with tuberculosis or other blood disease. A Massachusetts law imposes a fine upon 'whoever knowingly feeds or has in his possession with intent to feed to any milch cow any garbage, refuse, or offal collected by any city or town.' There is, however, no especial sanitary inspection of milk and its sources in any New England town or city. . . .

"Local boards of health, however, have considerable authority, and in several cases they have issued orders or made regulations in advance of the average practice of the State."

The germs in milk; studies of foremilk of cows, J. NELSON (*New Jersey Stas. Rpt. 1897, pp. 195–223*).—The following is the author's summary of his work in these lines:

"*Studies of the germs of milk, quantitatively considered, relative to the sources of contamination.*—Gelatin cultures were made from milk as freshly drawn from the cow, and the number of bacterial colonies developing were counted; then the increase in the germ content during cooling was determined; next, the increase due to the process of bottling. It was found that the germs multiply during the time elapsing before the milk is cooled, and that the various utensils with which the milk comes in contact during handling, cooling, bottling, etc., each contributes its quota of germ contamination, so that the germ content of the milk at the time it is placed in cold storage, within an hour after milking, is already 10 times as great as at first. The principal source of contamination was found to be the valves of the bottling machine. The first milk passing undergoes a doubling in its germ content.

"As an appendix to this section, the use of the [Star] cooler as a pasteurizing apparatus is considered. Steam is turned through the 'cooler' in place of cold water, and the resultant temperature of the milk is 150° F. Germ cultures showed a decrease in germ content of 0.95 under the crudest conditions and immediate cooling. Thus it appears as if this method could, with slight improvements, become successful and practicable.

"*Studies of the foremilk of cows.*—The first milk drawn from the udder, with aseptic precautions, was observed macroscopically. The different spurts were kept in separate tubes, and from each teat of each cow 3 different samples were prepared. The time elapsing before acidity developed and subsequent clotting was noted, and to aid in this determination the milk was colored with litmus from the start. A most complex variety of results was obtained, whose import can not be shown until the various germs producing the changes have been isolated and studied in pure cultures. The practical aim in this work is the development of a method of milk analysis which shall be expeditious, and shall give an idea of the quality of the bacterial flora which the individual cow favors and harbors in her udder. This has

two important bearings: On the one hand it will throw light on such diseases as garget, and on the other hand will show the keeping qualities of the milk, and the sort of butter or cheese it will produce. These are all-important considerations in respect to the characteristics of a good dairy cow."

Swedish butter exhibitions during 1897, N. ENGSTRÖM (*Tidskr. Landtmän, 18 (1897), No. 51, pp. 920–929; Nord. Mejeri Tidn., 12 (1898), No. 51, pp. 604, 605; 52, pp. 617–619; 53, p. 630*).—During the year 317 creameries exhibited 1,214 tubs of butter. The average score was 11.1 (on a total of 15 points), 44 per cent of the tubs scoring over 12 points. The average results for the year are shown in the following tables:

Swedish butter exhibitions, 1897.

Class of creamery.	Number of tubs.	Maximum score.	Percentage scoring above 12 points.	Average score.	Average water content.	Percentage containing above 15 per cent water.
		Points.		*Points.*	*Per cent.*	
Cooperative	477	14.2	56.0	11.5	13.2	4.0
Estate	316	13.8	36.7	10.9	13.5	8.9
Estate-proprietary	215	13.7	39.5	11.0	13.6	12.0
Proprietary	206	13.7	32.0	10.6	13.8	18.4
Average	1,214	14.2	44.0	11.1	13.4	9.2

Of the tubs exhibited, 1.7 per cent lost brine during storage, the average amount per tub being 0.45 lb., maximum amount, 1.68 lbs. There has been a uniform improvement in the average quality of the butter exhibited during the 4 years since the butter exhibitions were established.—F. W. WOLL.

Milk and dairy products, F. STOHMANN (*Milch- und Molkereiproducte: Ein Handbuch für Milchtechniker und Nahrungsmittelchemiker. Braunschweig: Friederich Vieweg & Sohn, 1898, pp. XXIX + 1031, figs. 235*).—This extensive treatise, which was issued a few months after the author's death, brings the literature of the subject down to within the last 2 or 3 years. In its scope it covers the whole field of the chemistry and properties of milk, the analysis of milk and dairy products, dairy bacteriology, and the utilization of milk in different ways, as in its original form, for butter making, cheese making, making of condensed milk, koumiss, kephir, etc. Although naturally devoted largely to cows' milk and its products, the milk of different kinds of animals and the products manufactured from it are included, with a discussion of the manufacture of oleomargarine, the recognition of oleomargarine and filled cheese, and the detection of these and other forms of adulteration.

Throughout the entire book the discussion is based upon the results of scientific investigations and experiments, and their application in practice is pointed out in a clear and concise manner. The production of milk, or what may be termed dairy farming, is not entered into at any length, although the effect of various methods of feeding and treatment of cows on the yield and composition of the milk and the specific effects of a large number of feeding stuffs on the quality of milk and dairy products are considered quite fully. The various operations in the creamery and cheese factory and in the handling of milk are treated at length, with illustrated descriptions of various forms of machinery and apparatus.

Altogether the book forms the most comprehensive treatise on the subject from a scientific standpoint that has been issued. The numerous references given in footnotes are a valuable feature. The method of treatment is such as to make the book

interesting and useful to educated dairymen. An unusually detailed table of contents and a comprehensive alphabetical index contribute to make the book a most valuable work of reference.

The development of the dairy cow, C. D. SMITH (*Indiana State Diary Assoc. Rpt. 1897, pp. 98-111*).—A historical account, with descriptions of some of the famous dairy cows.

The factors essential to secure profit in the dairy, C. D. SMITH (*Indiana State Dairy Assoc. Rpt. 1897, pp. 133-137*).—Special stress is laid upon the care of the dairy cow.

The cost of production, T. L. HAECKER (*Indiana State Dairy Assoc. Rpt. 1897, pp. 83-98, figs. 5*).—An address based upon the author's experience with the herd of the Minnesota Station.

Yields of Norwegian dairy herds, K. DÖHLEN and A. KJÖLSTAD (*Norsk Landmandsblad, 17 (1898), No. 8, pp. 81-84; 11, pp. 112, 113*).—The live weight of the herd of Smaalens cattle at Kalnäs agricultural school ranges from 670 to 1,000 lbs. and averages about 800 lbs. The average milk yield of 10 cows kept in the barn throughout the year was 5,640 lbs., with an average fat content of 3.7 per cent.

Yield of herd of Oestland cattle at Frogner, 1897, A. Kjölstad.— A herd of 14 head of Oestland cows at Frogner, with an average age of 7½ years, and an average live weight of 865 lbs., gave an average yield of 4,900 lbs. of milk in 1897, with a fat content of 3.72 per cent.—F. W. WOLL.

The college herd, F. W. MORSE (*New Hampshire Sta. Bul. 48, pp. 120, 121*).—Brief statistics are given on the milk production of the college herd.

"Making no deductions, the herd has been equivalent to 284 milch cows and 51 dry cows for 1 month, and has produced 145,019 lbs. of milk and 7,875 lbs. of butter, making the average monthly yield per head for 335 cows, 23.5 lbs. of butter and 24 cans of milk, or 282 lbs. of butter and 288 cans of milk per year.

"The only allowance to which attention is called is the fact that one-fifth of the herd's equivalent has consisted of heifers in their first lactation period."

Book of German cattle, RAMM and PAREY (*Deutsches Rinder-Merkbuch. Berlin: Paul Parey, 1898, pp. 129, figs. 102, col. pls. 8*).—Illustrated description of notable cows, bulls, and oxen of different breeds.

The feeding of milch cows, E. O. ARENANDER (*Nord. Mejeri. Tidn., 13 (1898), No. 16, pp. 212-214; 17, pp. 223, 224*).

Reindeer moss for milch cows, B. TORSSELL (*Meddel. K. Landtbr. Styr., 1897, No. 42, pp. 172, 173*).—The moss was found of no greater value for milch cows than is indicated by the chemical analysis, viz, about the same as straw-chaff.

The estimation of fat in condensed milk by the Gerber milk test, N. GERBER and M. M. CRAANDIJK (*Milch Ztg., 27 (1898), No. 39, pp. 611-613*).—The results of numerous determinations by this method are compared with gravimetric analysis. A weighed quantity of the condensed milk is diluted, and then treated similarly to ordinary milk, except that it must be heated longer and whirled longer in the centrifugal.

Extracts from the annual report of the chemical laboratory of the city of Altona, A. REINSCH (*Milch Ztg., 27 (1898), No. 31, pp. 484, 485*).—Relates to the results of examinations of butter, rancid butter, margarin, milk, and milk preparations.

Municipal control of dairies in Indiana, A. W. BITTING (*Indiana State Dairy Assoc. Rpt. 1897, pp. 147-152*).—A paper pointing out the advantages of dairy inspection.

Experience in preparing sanitary milk, B. C. COX (*Indiana State Dairy Assoc. Rpt. 1897, pp. 36-40*).—An account of the methods employed by the author.

Police supervision of the milk supply of Geneva, E. A. ACKERMANN (*Milch Ztg., 27 (1898), No. 29, p. 496*).—A summary of the results of the milk control.

The adulteration of dairy produce, R. HEDGERWALLACE (*Edinburg: C. & R. Anderson, 1898, pp. 89*).—This is a quite general paper, read before the Royal Scottish

Society of Arts. It treats of the local supply and the importation of dairy products, the forms of adulteration practiced, and the legislation on this point in various countries.

Note on the volume concentration of condensed milk, A. McGILL (*Analyst, 23 (1898), May, pp. 128, 129*).

Shipment of frozen milk (*Milch Ztg., 27 (1898), No. 36, p. 568*).—Fifty liters of milk were sent from an "ice dairy" in northern Prussia to Zurich June 1. It was contained in a square can packed in a wooden box with straw, and was sent by fast freight, but owing to delays at the custom-house was not received for testing in Zurich until June 9. Its temperature when opened was 7° C. It was entirely normal in taste and smell, and showed an acidity of 3.4° by the Soxhlet-Henkel method, which is said to correspond to the acidity of normal milk as it comes from the cow. The milk was, therefore, perfectly sweet and unchanged after being 9 days in transport, which is an indication of what can be done in sending milk cooled to freezing. The dairy from which it was sent will, it is stated, send 10,000 liters of cooled or frozen milk daily to Berlin, and guarantee to deliver it sweet to consumers. A similar establishment is in successful operation in Copenhagen.

Armenian mazoon, O. EMMERLING (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 10, pp. 418–420*).—Mazoon is an Armenian drink similar to kephir. Two bacteria have been isolated, one a micrococcus, the other a bacillus which is thought identical with *Bacillus acidi lactici*.

Experiments with Pfeiff's pasteurization apparatus, N. ENGSTRÖM (*Tidskr. Landtmän, 19 (1898), No. 14, pp. 237–242*).—The results show the apparatus to be of doubtful value, the product obtained being of inferior quality, and its capacity being small and decreasing as the pasteurization progresses.

On the importance of pasteurization in dairying, A. V. SCHRADER (*Biet, 19 (1898), No. 4, pp. 101–108*).

A survey of the creamery situation in Indiana, C. S. PLUMB (*Indiana State Dairy Assoc. Rpt. 1897, pp. 164–174*).—An account of the development and extent of the creamery system in Indiana, with statistics.

Experiment with the Alpha churn No. 3, KLEIN (*Milch Ztg., 27 (1898), No. 29, pp. 454–456*).—Experiments with this churn on cream of different degrees of acidity at different temperatures, etc.

Effect of the salt on the taste of butter (*Milch Ztg., 27 (1898), No. 38, p. 601*).—The Chamber of Agriculture for the Province of Posen has called attention to the fact that the salt used in creameries contains as high as 0.6 per cent of magnesium sulphate, and that this amount imparts a bitter taste to butter. Accordingly the Chamber of Commerce proposes to supply salt which has been tested and found to contain under 0.025 per cent of magnesium sulphate.

The butter-producing capacity of cows' milk can be increased by proper selection of breeding stock, H. BRANDTH (*Landmansblade, 31 (1898), No. 11, pp. 139, 140*).—Summary of the results of 10 years' work by a practical farmer.

Cheese from pasteurized milk, J. A. ANDRÉ (*Landtmannen, 9 (1898), No. 25, pp. 403, 404*).—The cheese is manufactured from a mixture of 10 per cent buttermilk, 25 to 50 per cent unpasteurized milk, and the rest pasteurized milk. The product is said to be of prime quality.

In No. 31 of the same journal (p. 504), a method of making cheese from pasteurized milk mixed with 5 per cent of buttermilk is given. [In both cases the cheese is evidently made from skim milk.]—F. W. WOLL.

The manufacture of Grana cheese, G. BILLITZ (*Milch Ztg., 27 (1898), No. 39, pp. 609–611*).—The results of experiments are reported.

Dairy experiments conducted at Mustiala experiment station, 1894–95, R. GRIPENBERG (*Meddel. K. Landtbr. Styr., 1897, No. 20, pp. 34–57*).—Reports are given of experiments with the Radiator, feeding experiments with cows of Ayrshire-Finnish and native Finnish breeds, trials of milk antiseptics, experiments with

Babcock and Gerber milk testers, trials with the Alpha-Colibri separator, feeding experiments with caraway hay for milch cows, and titration of sour cream.—F. W. WOLL.

Report of the [Massachusetts] dairy bureau, G. M. WHITAKER (*Agr. Massachusetts, 1897, pp. 281–303*).—This relates to the sale of oleomargarine, inspection of milk and milk supply of Boston, and gives general information relative to the dairy industry in the State.

VETERINARY SCIENCE AND PRACTICE.

Observations on the experiment cows with reference to tuberculosis, J. NELSON (*New Jersey Stas. Rpt. 1897, pp. 224–240*).—This portion of the author's report consists of a description of autopsies and of temperature tests.

"The members of the experiment herd have now been injected with tuberculin from 15 to 17 times within 3 or 4 years. In general, the results agree with the conclusions published in previous reports. Repeated injection of tuberculin does not seem to exert any decided influence, either for increase or for cure of tuberculosis of slightly tuberculous animals. The results in some cases appear to point in one direction and in others in the opposite direction, but in neither case so decidedly as to be of practical import. In some cows the reaction which tuberculin causes is entirely suppressed by repetition of injection, and in others it is only temporarily suppressed."

Cornstalk disease, A. T. PETERS (*Nebraska Sta. Bul. 52, pp. 51–62*).—The cornstalk disease of cattle and horses is described and the various theories which have been advanced as to its cause are discussed, the opinions of many investigators being quoted. Circulars requesting information concerning the prevalence of cornstalk disease in Nebraska were sent out, and the replies received are summarized.

"From the data gathered from these few letters and from past experience it is known that a great many cattle succumb to this disease. These further show that there is a great difference in the time that animals are in the fields before the first death occurs. It is also clearly shown that the stockmen have found a remedy in feeding a grain ration and not allowing stock to feed on cornstalks alone."

The prevalence, symptoms, and treatment of milk fever, garget, and abortion, J. NELSON (*New Jersey Stas. Rpt. 1897, pp. 241–260*).—The occurrence of milk fever and abortion in the college herd led the author to study these diseases and garget. A circular letter was sent to numerous localities in the State requesting information on the prevalence of these diseases in dairy herds and concerning the remedies employed, including the use of disinfectants.

Replies indicate that 64 herds were affected with milk fever, 70 with garget, and over 90 with abortion. In 25 of the herds abortion had prevailed to an extent ranging from 20 to 100 per cent. The symptoms, cause, and treatment of milk fever and garget are described. The reports received indicate that about 150 cows were affected with the former disease and that the majority died. During the past 4 years this disease has become less prevalent than formerly.

About 150 cases of garget are reported. Bovine abortion is discussed

at considerable length and the fact is noted that the disease is becoming less common, owing in part to the application of antiseptic methods of treatment. The primary cause of abortion is considered to be a specific germ, though it is noted that various other causes may also produce it.

The subject of immunity, contagiousness, modes of infection and treatment, antiseptics and disinfectants are briefly treated. The method of securing immunity by the first infection is not thought recommendable for the general practice since a considerable portion of the cows affected with abortion become sterile. The antiseptics and disinfectants noted are corrosive sublimate 0.1 of 1 per cent for general use; as, on the floor, full strength; for sponging the vulva, one-half strength; for injection, one-fourth strength; and for uterine irrigation, one-eighth strength. It is improved by an addition of 10 parts of salt; for irrigation purposes, by adding a mixture of glycerin and alcohol, 3 parts, or, for sponging, by an addition of one-fourth oz. of hydrochloric acid to 1 gal. of solution. Sulphate solution, consisting of 17 grains of copper sulphate to each ounce of water, or 3 lbs. iron sulphate to 30 gal., to be used in watering barn floors weekly; sulphuric acid 2 per cent, for barn floors; chlorid of lime, air-slaked lime, or land plaster for litter or manure; a carbolic acid mixture, consisting of 1 part carbolic acid, 2 of sodium carbonate, in 100 parts of water to be used for disinfecting the penis and for vaginal injection before service; and creolin, which is considered to be the best. It may be used for uterine irrigation in a one-half to 1 per cent strength or for vaginal injection in from 1 to 2 per cent strength; for sponging, 2 to 3 per cent strength, or for general disinfection of a barn as high as 4 per cent.

Tuberculosis of animals, E. NOCARD (*Les tuberculoses animales. Paris: Masson, 1898. Encyclopédie scientifique des Aide-Mémoire. Rev. in Jour. Hyg., 23 (1898), No. 1143, pp. 395, 396*).

Bovine tuberculosis, M. A. O'CALLAGHAN (*Agr. Gaz. New South Wales, 9 (1898), No. 8, pp. 837–849, pls. 3*).—The possibility of diminishing bovine tuberculosis is discussed and the results of the author's observations along this line are briefly noted, as well as the use of the tuberculin test. The need of experiments under Australian conditions is pointed out.

Tuberculosis in horses, TRUELSEN (*Berlin. Tierärztl. Wchnschr. 1898, No. 24, pp. 278, 279*).

On the relation of human tuberculosis to that of birds, M. NOCARD (*Ann. Inst. Pasteur, 12 (1898), No. 9, pp. 561–573*).

Combating tuberculosis in cattle, A. EBER (*Verhandl. Gesell. Deut. Naturf. u. Aerzte, 69 (1897), II, pp. 342–348*).

Investigations on the effect of tubercle bacilli and on preventive serums and similar substances, BABES and PROCA (*Ztschr. Hyg. u. Infektionskrank., 23 (1897), p. 331; abs. in Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 2–3, pp. 86–92*).

The biology of Bacillus tuberculosis, H. ARONSON (*Berlin Klin. Wchnschr., 6 (1898), No. 22; abs. in Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 2–3, pp. 85, 86*).

Notes on the study of pseudo-tuberculosis bacilli, J. LIGNIÈRES (*Rev. Veterin. Buenos Aires, 1898, No. 60, pp. 723–731*).

General etiology of actinomycosis, A. PONCET and L. BERÁRD (*Lyon Med., 1898, No. 18, pp. 5–13*).

Notes on actinomycosis in man, Grillo (*Riforma Med., 1898, No. 101, pp. 301–305; 102, pp. 315–318; 103, pp. 325–327*).

Micro-organisms which are related to Bacillus tuberculosis and which produce a mild form of tuberculosis in animals, A. Moeller (*Deut. Med. Wchnschr., 24 (1898), No. 24, pp. 376–379*).

Actinomycosis in horses, L. J. Hoogkamer (*Veeartsenijk. bladen v. Nederl.-Indië, 11, 1898, No. 3, pp. 174–176*).

A case of actinomycosis in man, together with a bacteriological study, Ancel and Thiry (*Une observation d'actinomycose humaine avec étude bactériologique: separate from Rev. Med. de l'Est, 1898, pp. 14*).

Contribution to the bacteriological study of anthrax, J. Lemos (*Rev. Soc. Med. Argentina, 1898, No. 28, pp. 31–41*).

An epidemic of charbon, Lardier (*Rev. Hyg., 1898, No. 5, pp. 431–438*).

Concerning immunity from splenic fever, A. Aujeszky (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 8, pp. 325–327*).

Rinderpest; its pathology and the means used to combat its invasion of South Africa, G. Turner (*Vet. Jour., 1898, Mar., pp. 217–224*).

The rinderpest in Basutoland, W. R. Davis (*Vet. Jour., 1898, Apr., pp. 252–257*).

Further studies on immunity from rinderpest, W. Kolle (*Deut. Med. Wchnschr., 24 (1898), No. 25, p. 396; abs. in Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 6–7, pp. 283–285*).

The blood serum of immune animals in combating rinderpest, A. Theiler (*Deut. Tierärztl. Wchnschr., 1898, No. 24, pp. 205–208*).

Cattle plague in young pigs, B. Vrijburg (*Veeartsenijk. bladen v. Nederl.-Indië, 11 (1898), No. 3, pp. 172, 173*).

On inoculation as a method of preventing hog cholera and on the identification of the hog-cholera bacillus, O. Voges and W. Schütz (*Ztschr. Hyg. Infektionskrank., 28 (1898), No. 1, pp. 38–124*).

The results of experiments on immunity from hog cholera, O. Voges and W. Schütz (*Deut. Med. Wchnschr., 24 (1898), No. 4; abs. in Hyg. Rundschau, 8 (1898), No. 11, pp. 535, 536*).

The action of serum as a preventive of hog cholera, F. Mesnil (*Ann. Inst. Pasteur, 12 (1898), No. 8, pp. 481–500*).—The method of preparation and action of the serum is given, together with details of some experiments.

Summary of the results of investigations on the foot and mouth disease by the commission for studying infectious diseases, Loeffler and Frosch (*Deut. Med. Wchnschr., 23 (1897), No. 39, p. 617; abs. in Hyg. Rundschau, 8 (1898), No. 10, pp. 498, 499*).

The susceptibility of herbivora to foot and mouth disease, A. Fehsenmeier (*Berlin Tierärztl. Wchnschr., 1898, No. 17, pp. 146, 147*).

Combating foot and mouth disease, Meifort (*Berlin Tierärztl. Wchnschr., 1898, No. 16, pp. 181–185*).

The duration of immunity from foot and mouth disease, Martens (*Berlin Tierärztl. Wchnschr., 1898, No. 15, p. 171*).

Concerning diphtheria in poultry, W. Eber (*Ztschr. Tiermed., 2 (1898), No. 3, pp. 201–204*).

Rendering animals immune to a mixture of diphtheria bacilli and streptococci, J. Bernheim (*Arch. Hyg., 33 (1898), No. 1–2, pp. 35–69*).

On the relation between the excretion of nitrogen in the metabolism of a horse and the production of diphtheria serum, G. Marenghi (*Centbl. Bakt. u. Par., 1. Abt., 21 (1897), No. 6–7, pp. 256–261*).—Experiments in which the nitrogen in the urine was determined were made with horses used for the production of diphtheria antitoxin. These are briefly reported, the following conclusions being drawn: Antitoxin serum is formed from materials furnished by the blood. Its formation is closely connected with biochemical processes which are evidenced by an increase in

the total nitrogen and urea nitrogen of the urine. The nitrogen introduced in the diphtheria virus is not sufficient to account for the excess. The change in the nitrogen content of the urine takes place very quickly. The animal organism takes an active part in the formation of this serum, even if this is not shown by fever or any local reaction. The blood retains the antitoxic properties for only a short time after the injections of diphtheria virus cease, and sometimes lose such properties even if the injections are continued.

Septicæmia in geese due to spirochate, GABRITSCHEROSKI (*Ztschr. Medizinalbeamte, 1898, 13; abs. in Ztschr. Fliesch u. Milchhyg., 9 (1898), No. 1, pp. 12–13*).

On the Hæmatozoan infection of birds, W. G. MACCALLUM (*Jour. Expt. Med., 3 (1898), No. 1; abs. in Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 6–7, pp. 282, 283*).

A case of disease similar to beri beri in chickens, C. EIJKMANN (*Arch. Path. Anat. u. Physiol. [Virchow], 148 (1897), No. 3, pp. 523–532*).

Cause of natural immunity of chickens to tetanus, N. ASAKAWA (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 4–5, pp. 166–174; 5–6, pp. 234–250*).

Contribution to the study of immunity, SAWTCHENKO (*Ann. Inst. Pasteur, 11 (1897), No. 12, pp. 865–890*).

Infectious pneumonia of sheep, W. R. DAVIS (*Vet. Jour., 1898, Apr., pp. 233–235*).

The Croonian lectures on the chemical products of pathogenic bacteria considered with special reference to enteric fever, S. MARTIN (*British Med. Jour., 1898, No. 1955, pp. 1569–1572; 1956, 1644–1646*).

Micro-organisms and bacterial poisons in brain and spinal cord, J. SIETZ (*Arch. Path. Anat. u. Physiol. [Virchow], 150 (1897), No. 1, pp. 33–51*).

Etiology of epizootic abortion, S. J. J. HARGER (*Jour. Comp. Med., 1898, No. 4, pp. 226–231*).

The prevalence, cause, and treatment of bovine abortion, milk fever, and garget, J. NELSON (*New Jersey Stas. Bul. 127, pp. 24*).—A reprint from the Annual Report of the station for 1897 (see p. 494), with the addition of a bibliography of recent literature on the subject.

A new Trichophyton which produces herpes in horses, MATRUCHOT and DASSOUVILLE (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 5, pp. 279–281*).—The authors describe an outbreak of this disease among the horses of the Twelfth Artillery. The cause is said to be a new Trichophyta. Its appearance and growth on various culture media are described, and the successful inoculation of the disease on man and on guinea pigs.

Aphtha or vesicular stomatictis of the horse, D. HUTCHEON (*Vet. Jour., 1898, July, pp. 54–56*).

Ankylostomiasis of horses, S. VON RÁTZ (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 8, pp. 289–305*).

Botryomykosis in man and animals, SCHNEIDEMÜHL (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 6–7, pp. 271–277*).—This article includes an address before the Physiological Society of Kiel.

Trichinæ: German inspection of American hog products, J. A. BARNES (*U. S. Consular Rpts., 1898, No. 217, pp. 200–203*).—The rigid laws regarding American meat imported into Germany are discussed, as well as the possibilities of the importation into Germany through Belgium of uninspected meats.

The symptomology of animal parasites, PEIPER (*Deut. Med. Wchnschr., 23 (1897), No. 48; abs. in Centbl. Bakt. u. Par., 1. Abt., 23 (1898), No. 24, pp. 1061, 1065*).

Zamia poisoning, A. W. V. CRAWLEY (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 5, pp. 399–402*).—Notes are given on the effect and treatment of zamia poisoning in cattle. The symptoms of poisoning, post-mortem appearance, and methods of treatment are given in some detail. According to the author, zamia acts as a cumulative poison, and cattle were probably encouraged to eat it on account of other feed being scanty and dry. Attempts are being made to ascertain the active principle or alkaloid causing the poisoning, and it is suggested that if possible all such plants should be eradicated from pastures.

STATISTICS.

Index to volumes 21 to 50, Die Landwirtschaftlichen Versuchs-Stationen, F. NOBBE and L. HILTNER (*Landw. Vers. Stat., 50 (1898), Sup., pp. 1-193*).—Author and subject indexes to the contents of the last 30 volumes of this journal.

Dairy experiment station of the Chamber of Agriculture of the Province of Schleswig-Holstein at Kiel, R. EICHLOFF (*Milch Ztg., 27 (1898), No. 27, pp. 420-423, figs. 4*).—An illustrated description of the buildings, with ground plans; the organization, work of the station, etc.

Fourth report of progress on extension work, I. P. ROBERTS (*New York Cornell Sta. Bul. 146, pp. 633-654, maps 3*).—This bulletin deals with the progress of the State extension work in agriculture. Part I contains the reports of the various departments concerned in investigational work; Part II deals with the educational work. During the period May, 1897, to February, 1898, more than 700 lessons and lectures have been given throughout the State; 30,000 teachers and 16,000 school children have been sent leaflets on nature study, and 2,500 young farmers have been enrolled in the agricultural reading course. Previous reports of extension work have been given in Bulletins 110, 122, and 137 of the station (E. S. R., 8, pp. 135, 740; 9, p. 699).

Report of the director of New York State Station, W. H. JORDAN (*New York State Sta. Bul. 142, pp. 721-740*).—A comprehensive review of the work of the different departments of the station during the year, giving results in some instances, with a list of the bulletins published in 1897.

Annual Report of Oklahoma Station, 1898 (*Oklahoma Sta. Rpt. 1898, pp. 4*).—A report on the personnel, equipment, and outline of work of the station, with a list of bulletins issued during the year and a financial statement for the fiscal year ending June 30, 1898.

Ninth Annual Report of New Hampshire Station, 1897 (*New Hampshire Sta. Bul. 48, pp. 116-149, figs. 15, map 1*).—This contains a financial statement for the fiscal year ending June 30, 1897; a report of the vice-director, and reports of the agriculturist and horticulturist, entomologist, bacteriologist, and meteorologist, noted elsewhere.

Annual Report of New Jersey Stations, 1897 (*New Jersey Stas. Rpt. 1897, pp. XIX + 536, figs. 71, pls. 11, dgm. 1*).—This contains a financial statement of the State Station for the year ending October 31, 1897, and of the college station for the fiscal year ending June 30, 1897; a report of the director reviewing the work of the different departments for the year, and reports of the chemists, assistant in horticulture, assistant in dairy husbandry, biologist, botanist, and entomologist, noted elsewhere.

NOTES.

IDAHO UNIVERSITY AND STATION.—Herbert T. Condon has been elected registrar and accountant of the university and station.

MICHIGAN STATION.—The average yield of sugar beets on the station grounds is 12.93 tons per acre; the average percentage of sugar, 13.72. The results of cooperative experiments are being worked out. The factory at Bay City is in successful operation, with 3,000 acres of beets to work up. Experiments to test the value of beet pulp for cows, beef cattle, and sheep are planned for next winter. The year's record with a grade dairy herd of 29 cows has been completed. The average milk yield of the cows, rejecting one accidentally injured and another condemned as tuberculous, was 7,008 lbs. The fat yield averaged 257.57 lbs. The net profit from the herd, including in the expenses the cost of the care and milking as well as the food, but not crediting the value of the 200 tons of manure made, was $277.59.

NEW YORK STATE STATION.—Firman Thompson, assistant chemist at the station, has resigned his position to accept an appointment under Dr. Walter Maxwell at the Hawaiian Experiment Station and Laboratories. H. A. Harding, bacteriologist of the station, assumed active duty January 1, 1899.

VERMONT STATION.—At the recent session of the legislature of Vermont three bills were passed which affect and add to the work of the station. (1) A bill appropriating $1,000 annually toward the printing of the station report; (2) a bill regulating the sale of concentrated commercial feeding stuffs, being similar in its nature to the law which has been in force for something over a year in the State of Maine; (3) a bill requiring that the correctness of all Babcock glassware in use at creameries and cheese factories for dividend making shall be certified, and that all operators of the Babcock test for dividend making shall be duly licensed, the licenses to be issued upon demonstration of their ability properly to operate the test. The execution of the latter law is placed in the hands of the superintendent of the dairy school.

PERSONAL.—In connection with the death of the late Col. George E. Waring, jr., formerly commissioner of street cleaning in New York City, it is interesting to note his interest in agriculture and his services and writings during his earlier life. As early as 1853 Colonel Waring studied scientific agriculture under Dr. James J. Mapes, one of the pioneer agricultural chemists of the country, and in 1855 he assumed the management of Horace Greeley's famous farm at Chappaqua, New York. After the civil war he removed to Newport, Rhode Island, where for 10 years he had charge of the Ogden farm, and during this time wrote the interesting Ogden Farm Papers for the *American Agriculturist*. In 1868 he originated the American Jersey Cattle Club, the first American association of its kind to publish its own herd book, of which he was the secretary and editor of the Herd Book until 1882. In 1870 he introduced the Trophy tomato, which marked the beginning of the successful production of the tomato for shipping and canning. He traveled through Holland, Normandy, Brittany, and the Channel Islands studying the agriculture of these countries, and as a result introduced into this country the Swartz system of cold deep setting of milk, which was the forerunner of the present systems of deep setting. Among his published agricultural works are the following: Elements of Agriculture (1854), Drainage for Profit and Drainage for Health (1868), The Handy Book of Husbandry (1869), The Sanitary Draining of Houses and Farms (1871), A Farmer's Vacation: Travels in Holland, Normandy, Brittany, and the Channel Islands (1875), Sewage and Land Drainage (1889), and Modern Methods of Sewage Disposal (1894).

Agricultural Education In Russia.—The Government of Russia is planning for the establishment of a quite extensive system of agricultural education. At a recent meeting of the agricultural council, an advisory body of which the minister of agriculture is chairman, an outline presented by the minister was considered at length and a general plan of agricultural education was elaborated. The introductory to this document states that notwithstanding the fundamental importance of agriculture to Russia and the great fertility of some of the Russian soils, "the crops obtained even on the chernozem (black soil) are only one-third to one-half as large as those harvested from the incomparably inferior soils of Western Europe. Almost everywhere in Russia the primitive processes of farming are persistently followed by the farmers, while the number of persons who are fitted by education and training to disseminate information on the rational methods of agriculture is comparatively insignificant." The scheme outlined provides for (1) higher education, furnished by independent agricultural institutes located in the chief agricultural zones of Russia, and by chairs of agriculture and allied sciences in the universities; (2) agricultural high schools, which are in the nature of technical schools and schools with courses in agriculture; (3) lower agricultural schools; and (4) the diffusion of general agricultural information. The schools for the so-called lower education include (*a*) secondary agricultural schools, (*b*) primary agricultural schools, (*c*) agricultural classes, and (*d*) practical agricultural courses. These lower schools are to be under the jurisdiction of the minister of agricultural and imperial domains. They are to be maintained at the expense of municipalities, local communities, associations, etc., but may receive a part of their support from the Government. They are to have the franking privilege for official mail matter and packages not exceeding 36 lbs. in weight. The secondary schools are to be established on government land or land donated for that purpose. The other lower agricultural schools may be established on private estates. The secondary schools are open to young men of all conditions who have completed the course in the primary public schools. The course of instruction covers 4 years, and includes in addition to the general studies the elements of the natural sciences, agricultural and rural economy, cattle raising, veterinary, agricultural law, horticulture, gardening, etc., together with carpentry and blacksmithing in their application to agricultural machinery. The primary agricultural schools are open to all who can read and write and have a knowledge of arithmethic as far as fractions. The courses last from 1 to 3 years. They include, aside from general studies, instruction in the elements of agriculture, with practical exercises. The classes in agriculture are intended for the instruction of young men of the peasant class. The course does not last longer than 2 years, and consists in the study of the rudimentary principles of agriculture and their application to the local conditions. The successful completion of the courses in these 3 grades of the lower agricultural schools carries with it certain reductions in the military requirements, dependent upon the grade. The practical agricultural courses are designed to impart popular information in particular branches of agriculture. The instruction does not continue for more than a year, and consists in demonstrations, talks, and practical exercises in different branches of agriculture in their application to local conditions, and especially to the conditions of the peasants. The diffusion of general agricultural information is to be provided for by (1) the organization of public readings or lectures on agricultural questions for the benefit of different classes of the population, (2) instruction of the teachers in the public schools in agriculture, horticulture, gardening, apiculture, etc., and providing the public schools with small plats of land and means for cultivating the same, (3) the teaching of agriculture in the normal schools, and (4) the introduction of supplementary courses in agriculture in the village schools. There are now in Russia 3 schools for higher agricultural instruction, 9 agricultural high schools, 83 lower schools, and 59 special courses. Steps have already been taken for the establishment of about 50 additional agricultural schools.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director*,

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers, and Soils (including methods of analysis), and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
——— ———.—Entomology and Veterinary Science.
R. A. EMERSON—Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 6.

Among the many important services which the late Senator Justin S. Morrill rendered to his country during his long and honorable career as a member of Congress none so justly entitle him to lasting remembrance as a benefactor of mankind as those by which he became a potent factor in the advancement of science and education in every State and Territory of the Union. Growing up under the thoroughly democratic conditions existing in rural New England in the earlier half of this century, and coming to Congress in the prime of life after a successful experience as a business man and a farmer, his mind opened readily to receive the new ideas regarding education in the arts and sciences which were then being actively discussed by the leaders of public opinion in this country and abroad. The conditions which gave rise to this agitation have been thus described by Prof. W. H. Brewer, who has himself been closely identified with the great movement in which Senator Morrill performed such distinguished services:

"The period between 1840 and 1860 was a peculiar one in the history of the world's intellectual activity and material progress. At its beginning some of the physical sciences, more particularly chemistry and geology, were scarcely 50 years old, but they had already revolutionized some of the arts and produced great changes in agriculture. All this had taken place within the lifetime of the older workers then in the field. Popular works on science were widely read, and had prepared the public mind to cherish hopes, perhaps exaggerated, of the benefits to come by the applications of science, and had greatly stimulated intellectual activity in this new field of knowledge. . . .

"In a thousand and one ways, more in the other lines than in agriculture, discovery, invention, and the application of scientific laws to the arts and industries were playing a part in the development of the material resources of the civilized world and modifying the industries and occupations of men. There was then an absorbing interest in the growing steam transportation; railroads and ocean steamships then came into use and were made practicable; iron working, dyeing, and many other arts were being revolutionized by chemistry; commercial fertilizers were coming to be used; the electric telegraph, just invented, first came into use during this period; other events, some of them political, were

profoundly affecting the current of human activity; prices, which had been falling from the decline of the production of silver in Mexico, began to rise with the discovery and production of gold in California. This was the beginning of an era in the rise of prices and of material prosperity unexampled in the history of civilization. . . .

"All these influences produced a deep and lasting effect on the theories and practice of education. The 'old education,' as it was called, did not supply the new wants. There was a loud and discordant demand for something else. The many agreed only in this, that less Latin and Greek (which had before been considered the corner stone and substance of a liberal education) be taught and in their place more science; or at least that, whatever place the old college curriculum might have in the future, new systems of education were required in this new development of civilization. . . . This discussion, along with that of elective studies instead of a rigid curriculum, went on in all the colleges and universities in the land. The University of Virginia already had elective courses. All tried in some way to expand in the direction of the physical sciences. . . . Going along with these changes in collegiate instruction there was much clamor for purely technical schools of special kinds. In no direction was this more marked than in agriculture."

As attempts to establish scientific and technical schools in the several States increased in number and public interest in this matter grew apace, the attention of Congress was naturally drawn to this subject, but it was not until the movement for securing national aid for such institutions found in Mr. Morrill an active, wise, and persistent leader in shaping and directing legislation on its behalf that success was attained. The records of Congress show that only a man thoroughly persuaded of the importance and wisdom of this great enterprise would have persevered as Mr. Morrill did in the face of much misunderstanding and opposition until the desired end was finally attained.

On December 14, 1857, Mr. Morrill, then a Member of the House of Representatives, introduced a bill authorizing the establishment of industrial colleges in every State and granting for their maintenance 20,000 acres of the public land for each Member of Congress. This bill was referred to the Committee on Public Lands, which brought in an adverse report April 15, 1858. Nevertheless in the following session of Congress the bill passed both Houses, but it was vetoed by President Buchanan. The only effect of this serious rebuff on Mr. Morrill was to lead him to broaden the scope of the measure, and in December, 1861, he introduced an amended bill which bestowed 30,000 acres of land for each Member of Congress upon the several States for the establishment of colleges "where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in order to promote the liberal and practical education

of the industrial classes in the several pursuits and professions in life." After several months this bill was also reported on adversely by the Committee on Public Lands, but in the meantime it had been introduced in the Senate, where it passed on June 10, and a few days later was taken up and passed by the House and received the approval of President Lincoln. This act had been drawn on broad lines, and under its fostering influences a great variety of institutions were developed and have increased in strength and importance with the growth of public sentiment regarding the value of scientific and technical education and the better definition of the proper limits and scope of education along these lines.

When it became apparent that the progress of these institutions would be seriously impeded without further provision by the National Government for their maintenance, Mr. Morrill secured the passage of the act of 1890, by which more than a million dollars is annually paid from the National Treasury to meet the expenses attending instruction in certain branches in these institutions.

We have in this country to-day 66 institutions organized under the Morrill acts of 1862 and 1890. These institutions have over $50,000,000 in permanent endowments, buildings, and equipment, and an annual revenue of nearly $6,000,000. They employ over 2,000 persons in their faculties and give instruction to about 30,000 students.

But Mr. Morrill was closely identified with other great institutions for the advancement of science and learning. He took an active part in building up the great Congressional Library and providing for the magnificent building with the aid of which this library is destined to be ever hereafter an important factor in the education of our people. He served for fifteen years as a regent of the Smithsonian Institution, during which time he labored persistently for the enlargement of the opportunities of the institution, and, among other things, he introduced and secured the passage of the act establishing the National Zoological Park. At the meeting of the board of regents of the Smithsonian Institution at which the death of Senator Morrill was announced one of the members of that distinguished body, in an address to his associates, used these words:

"In the grandeur of his country he felt the patriot's pride. He sought to make this Capital City worthy of the people to whom it belonged, and the Smithsonian Institution was regarded by him as a chief factor in its future greatness and renown.

"He was, in my judgment, a true American nobleman. Here, as elsewhere, distinction imposes obligations—*noblesse oblige.* No books of heraldry and no blazoned emblems are necessary to evidence the rank of Senator Morrill. His patent of nobility is recorded in the hearts of a grateful people."

CONVENTION OF ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, 1898.

W. H. Beal,

Office of Experiment Stations.

The fifteenth annual convention of the Association of Official Agricultural Chemists was held in the lecture hall of the Columbian University at Washington, D. C., November 11, 12, and 14, 1898. About 70 chemists were in attendance.

The annual address of the president, A. L. Winton, briefly reviewed the history and scope of the work of the Association, and pointed out some important new lines of investigation, among the latter being a study of materials used as insecticides and fungicides, and the establishment of standards of purity for foods, and especially for spices. Attention was called to the importance of using a greater variety of materials in the cooperative test of methods by the Association, so that these shall be strictly tests of the accuracy of the methods applied to all classes of substances as distinguished from trials of the skill of the analyst.

A committee, consisting of R. C. Kedzie and M. E. Jaffa, was appointed to wait upon the Secretary of Agriculture and invite him to attend the meetings of the Association. The Secretary appeared before the Association and addressed it briefly. He noted some of the more important ways in which the work of the chemist has benefited agriculture, dwelling especially upon the chemist's relation to sugar production, and suggested other lines of inquiry which might be profitably undertaken with a view to reducing our imports.

FERTILIZERS.

Nitrogen.—A report on this subject, prepared by R. J. Davidson, referee, was read by the secretary. This gave results of tests by 11 analysts of the modified Kjeldahl, modified Gunning, absolute, Ulsch-Kjeldahl, and Ulsch-Gunning methods on 12 samples of fertilizers containing nitrogen in various forms; as well as comparative tests by 12 analysts of the pepsin-hydrochloric acid and 2 per cent permanganate of potash methods for the determination of availability of organic nitrogen in fertilizers, on dried blood, cotton-seed meal, tankage, fish scrap, meat scrap, castor pomace, steamed leather, bone meal, and hoof meal.

The results indicated that the present official methods for nitrogen are satisfactory, and no changes in them were recommended by the referee.

C. H. Jones called attention to a study which had been made at the Vermont Station of the alkaline-permanganate method for determining the availability of organic nitrogen in fertilizers. The main results of this work are summarized as follows:[1]

"(1) The alkaline-permanganate method (16 gm. potassium permanganate, 150 gm. sodium hydrate to 1,000 cc.; 100 cc. used in 600 cc. flask; digestion for an hour below boiling, followed by an hour's distillation), has shown in our hands broad distinctions between materials of animal origin of high and low nitrogen availability, provided amounts of substance equivalent to 0.045 gm. of nitrogen are used.

"(2) It is simpler and far more rapid than the pepsin-digestion method, and should prove particularly useful in eliminating quickly from a long list of fertilizers a large share of goods which would surely show high availabilities by the longer and more tedious processes. Its failure to show a sufficient availability with unacidified vegetable ammoniates may be overcome by the use of the pepsin method in doubtful cases.

"(3) Materials falling below 50 per cent nitrogen availability by this method are open to suspicion; those falling below 40 per cent are surely of little value for the production of crops. All such, however, should be likewise tested with pepsin, and, if opportunity admits, may be subjected to vegetation tests.

"(4) The alkaline-permanganate method should be considered an aid to vegetation tests rather than a substitute for them."

H. J. Wheeler, in discussing this subject, questioned the accuracy of the results of vegetation tests for availability of nitrogen in dried blood.

The referee for the ensuing year was instructed to further test the permanganate method.

Potash.—The report on potash was submitted by C. H. Jones. This report recorded the results obtained by 9 analysts in a comparison of the present Lindo-Gladding and optional methods for the determination of water-soluble and acid-soluble potash in wood ashes and cotton-hull ashes, as well as the results of tests of methods for determining chlorin in fertilizers.

The results indicated that these methods are accurate and reliable for the determination of potash in ashes. It is necessary, however, in the Lindo-Gladding method to see that the potassium-platinum precipitate is perfectly soluble in water.

B. B. Ross called attention to the fact that certain kinds of asbestus are attacked and dissolved to an appreciable extent by the ammonium chlorid solution used in washing the potassium-platinum precipitate.

The referee recommended the following method for determining chlorin in fertilizers, which has been used at the Vermont Station with satisfactory results for several years. To 50 cc. of the Lindo-Gladding solution for potash (equivalent to 1 gm. of original substance), add an excess of nitric acid and as many cubic centimeters of silver nitrate solution (1 cc. of which corresponds to chlorin equivalent to 1 per cent of potash, K_2O, on a basis of 1 gm. of substance) as the percentage of K_2O found +0.5 per cent; boil the solution for about 5 minutes, stir,

[1] Vermont Sta. Rpt. 1898, p. 171.

and allow the silver chlorid to settle. Decant a small portion of the supernatant liquid into a test tube. Test one portion of this for chlorin with a small crystal of silver nitrate and the other for silver with hydrochloric acid or ammonium chlorid. If an excess of silver is shown, collect the silver chlorid precipitate on a filter, dry, and weigh in the usual manner.

Phosphoric acid.—The referee on phosphoric acid, B. W. Kilgore, reported comparative tests by 19 analysts of the gravimetric and volumetric methods on cotton-seed meal, South Carolina rock, monosodium phosphate, and slag. A very close agreement between the results by the two methods was obtained.

High results were sometimes obtained in the volumetric method when a large excess of molybdic solution was used. Complete precipitation was obtained in the cold when the solution was shaken for 15 minutes or more.

H. A. Huston suggested that the occasional high results obtained by the volumetric method on slag might be due to the presence of manganese. This could be corrected by adding a small quantity of ferrous ammonium sulphate.

The volumetric method in the following slightly modified form was made provisional. Dissolve the substance according to prescribed methods, except that sulphuric acid must not be used. Make up to a convenient volume and use aliquots corresponding to 0.4 gm. of substance for percentages below 5 or 6, 0.2 gm. for percentages between about 6 and 20, and 0.1 for percentages above 20. Add 15 gm. ammonium nitrate, dilute to 75 to 100 cc., and heat in a water bath to 60 to 65° C. Add 20 to 25 cc. of freshly filtered molybdic solution for percentages below about 6, 30 to 35 cc. for percentages below about 20, and 40 cc. for percentages above about 20. Digest for 15 minutes, filter at once, and wash twice by decanting with water, using 25 to 30 cc. each time, agitating the precipitate thoroughly and allowing it to settle well. Transfer to filter and wash 5 or 6 times, using enough water to make with decantation washings about 200 cc. Transfer the precipitate to the precipitating vessel, dissolve in an excess of standard alkali, add a few drops of phenolphthalein, and titrate with standard (nitric) acid. Instead of precipitating in a bath at 60 to 65° C., the precipitation may be made at room temperature by shaking for about 30 minutes in some convenient form of shaking apparatus.

The referee suggested that convenient forms of filters for this work may be made by putting into the glass tube used for holding Gooch crucibles a perforated porcelain disk to which is attached a stout piece of wire. This wire extends through the neck of the tube, and is used to push out the filter and precipitate after filtration. The porcelain Gooch crucible with false bottom and the deep form of Hirsch funnel are also recommended. These three with felts of asbestus and suction give good filtrations.

Uniform fertilizer legislation.—The committee appointed by the Association to confer with a similar committee appointed by the Association

of American Agricultural Colleges and Experiment Stations on uniformity in fertilizer laws recommended the adoption of the following as points which should be made uniform in the laws of the several States:

"(1) All substances containing nitrogen, potash, or phosphoric acid, sold, offered, or exposed for sale for manurial purposes, excepting the dung of domestic animals when sold as such, should be subjected to inspection.

"(2) Each package of manurial substance as above defined, sold, offered, or exposed for sale, should bear a printed, legible guaranty.

"(3) The number of net pounds in each package should be stated.

"(4) Each package should bear the brand, name, or trade-mark and the name and address of the manufacturer.

"(5) The quantities of manurial ingredients should be expressed in percentages.

"(6) The guaranteed statements on the packages or forwarded to the inspectors need not be in the form of an affidavit.

"(7) Sealed samples of fertilizers offered for sale need not be sent by the manufacturers to the inspectors.

"(8) In lots of 5 tons or less, samples should be drawn from at least 10 packages, or if less than 10 packages are present, all should be sampled; in lots of over 5 tons, not less than 20 packages should be sampled.

"(9) Duplicate samples should be drawn and sealed in the presence of the party or parties in interest, or their representatives, one of the samples to be taken by the collector and the other left with the party whose goods were inspected, subject to the call of the manufacturer.

"(10) Total nitrogen should be guaranteed in all cases, and nitrogen in the form of nitrates or of ammonium salts should be guaranteed separately, if the manufacturer desires credit therefor.

"(11) Total phosphoric acid should be guaranteed in all cases, and soluble, reverted and insoluble separately, if the manufacturer desires credit therefor.

"(12) Potassium should be guaranteed as potash (potassium oxid) soluble in water.

"(13) When chlorin is present in fertilizers, manufacturers shall guarantee the maximum percentage thereof.

"(14) Only statements of the minimum amount of the substances present, except in the case of chlorin, should be made. For example, instead of guaranteeing from 2 to 4 per cent of potash, guaranties should read thus: 2 per cent of potash.

"(15) It should be specified that the methods of the Association of Official Agricultural Chemists should be used for official work.

"(16) An imprisonment clause for violation of fertilizer laws should be omitted.

"(17) Manufacturers should not be obliged to secure bondsmen.

"(18) Commercial valuations should not be affixed to the published analyses of manurial substances.

"(19) A definition of the term 'brand' should be inserted wherever a brand tax is assessed.

"(20) The guaranty should state the ingredients guaranteed in the following form and order:

"...... per cent phosphoric acid soluble in water.
"...... per cent phosphoric acid reverted.
"...... per cent phosphoric acid insoluble.
"...... per cent phosphoric acid total.
"...... per cent nitrogen in nitrates.
"...... per cent nitrogen as ammonia.
"...... per cent nitrogen total.
"...... per cent potash soluble in water.
"...... per cent chlorin.

"Ingredients not present should be omitted from the guaranty, and no other form of statement should be interpolated."

The recommendations of the committee were adopted, and the committee was continued[1] with instructions to use every effort to carry into effect the recommendations of the report.

SOILS AND ASH.

Separate reports were submitted on these subjects, the first on soils by the referee, H. Snyder, the second on ash by the associate referee, B. L. Hartwell. The first summarized results of comparative tests by 8 analysts on soils of known deficiencies of the $\frac{1}{5}$ normal hydrochloric acid method for determining available phosphoric acid and the calcium chlorid and ammonium chlorid methods for determining available potash. In addition to these principal lines of work, determinations were made of total and humus nitrogen and calcium carbonate in the soils. In some of the determinations of potash the electrolytic method was used.

H. Snyder also presented a paper on "Problems in soil investigations," in which a plea was made for systematic soil study and uniform methods. The importance of taking into consideration the acid and basic characteristics of soils was pointed out, and the question of standards of fertility was discussed.

H. J. Wheeler read a paper on methods of determining the fertilizer requirements of soils, in which attention was called to the unreliability of soil tests of fertilizers under certain conditions, e. g., with a deficiency of lime or water. The conclusions of this paper were based upon the results of several years' experiments at the Rhode Island Station.

Two papers by C. G. Hopkins were submitted to the Association: (1) "A rapid method of mechanical soil analysis, including the use of centrifugal force," and (2) "A plea for a scientific basis for the divisions of soil particles in mechanical analysis."

H. W. Wiley spoke of the increasing importance of soil analysis, and referred to the Hawaiian soils as opening up new and interesting problems in soil investigation. He also called attention to the tendency to increased acidity in arable soils as a fact which should always be borne in mind in soil investigations.

H. Snyder, J. A. Myers, M. E. Jaffa, H. A. Huston, and H. J. Wheeler also discussed different phases of the question of soil investigation.

The $\frac{1}{5}$ normal hydrochloric acid method for available phosphoric acid gave very satisfactory results in the tests and was made a provisional method of the Association. In the method for determining humus nitrogen the soil is to be exhausted with 3 per cent sodium hydrate after treatment with 2 per cent hydrochloric acid and washing. The calcium chlorid method for determining available potash is abandoned.

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[1]The committee for the Association of Official Agricultural Chemists is H. W. Wiley, B. W. Kilgore, H. A. Huston, H. B. McDonnell, and B. B. Ross. The committee for the Association of American Agricultural Colleges and Experiment Stations is H. J. Wheeler, H. P. Armsby, E. H. Jenkins, M. A. Scovell, and C. D. Woods.

The referee for the next year was instructed to test the so-called international method (treatment with 3 per cent nitric acid) for determining available potash, and Hallemann's method (treatment with carbonated water) for determining lime, and also to further test the ammonium chlorid method for available potash.

B. L. Hartwell, associate referee, reported the results of comparative tests of methods by 3 analysts on hay ash. The results show that the accuracy of the methods is largely dependent upon the soluble silica present. The thorough revision of the methods was proposed, and it was suggested that they be tested on mixtures of known composition approximating the composition of ash.

FOODS AND FEEDING STUFFS.

The report on this subject, which was submitted by W. H. Krug, referee, gave the results of comparative tests by 13 analysts of the diastase method for carbohydrates in barley and bran, by 7 analysts of the phenylhydrazin and phloroglucin methods for pentosans in the same substances, and by 6 analysts of methods of determining galactan. The importance of making a microscopic examination for the purpose of showing when the conversion of starch by the diastase is complete was brought out in these tests. The phloroglucin method for pentosans as a rule gave higher results than the phenylhydrazin method.

H. W. Wiley spoke of the difficulty of the exact determination of starch, but stated that in his opinion the diastase method is the best yet offered. He also stated it as his belief that our present methods account for all substances which occur in the nitrogen-free extract of cereals and cereal products. H. Snyder spoke of the importance of determining the acids in food. H. A. Huston suggested that a study of the alkali extract of foods and feeding stuffs would throw some light on the constitution of the nitrogen-free extract.

The following recommendations of the referee were adopted by the association: Three grams of material are to be used in the determination of starch by the diastase method. The substance is to be treated with diastase until the presence of starch is no longer shown by the microscope. The acid solution after inversion is to be nearly instead of exactly neutralized. The phloroglucin precipitate is dried by aspirating ½ hour and then heating in an oven for 3½ to 4 hours. In the diastase method blank determinations to test reagents should be made. In the determination of galactan the material for the test, 3 gm., is to be extracted 5 times with 10 cc. portions of ether. The association voted to adopt the factors for calculating pentosans recently proposed by Krüger and Tollens[1] instead of those used at present in the official method. The referee called attention to the importance of using phloroglucin free from diresorcin. To detect this substance dissolve the phloroglucin in acetic acid and add a few drops of strong sulphuric acid. A violet color shows the presence of diresorcin.

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[1] Ztschr. Angew. Chem., 1896, p. 33.

Food adulteration.—A report on this subject, by W. S. Sweetser, was read by the secretary. This report was confined to a discussion of results obtained by 3 analysts in determining starch in spices by the diastase and direct inversion methods. In this connection W. D. Bigelow spoke of the value of starch determination in detecting adulteration in spices. Standards and quick methods for this purpose are needed.

A. L. Winton referred to the work in this line at the Connecticut State Station, and stated that while microscopic examination is as a rule the most reliable means of detecting the principal adulterations in spices and similar products, chemical methods are urgently needed.

The referee suggested that his successor should compare different methods on spices low in starch, and also test the effect of longer digestion and interrupted digestion with diastase.

Food standards.—An elaborate report on this subject was presented by W. Frear, chairman of the committee appointed at the last convention to consider this subject. This report pointed out the inapplicability of European standards to American food products, and outlined an elaborate plan for the compilation of analyses of such material. In the plan proposed, the data are to be classified as follows: (1) Maxima, minima, and averages of the principal constituents of normal foods; (2) data showing the variations in composition due to differences in origin or treatment; and (3) the maxima of injurious constituents which normally occur in foods. In the organization of the work three subcommittees have been provided for: (1) On rules, forms, selection of data, etc., W. Frear, M. A. Scovell, and H. W. Wiley; (2) lists of food chemists of the world, H. A. Weber, E. H. Jenkins, and H. W. Wiley; and (3) digest of food laws, E. H. Jenkins, M. A. Scovell, and H. W. Wiley. A classification of the different food materials of which the analyses are to be compiled is given, and the different subjects are assigned to editors.

The following delegates to the pure-food congress were appointed: Delegates, H. W. Wiley, W. Frear, A. L. Winton, C. D. Woods, and W. D. Bigelow; alternates, W. O. Atwater, A. B. Peebles, H. J. Patterson, L. L. Van Slyke, and W. H. Krug.

DAIRY PRODUCTS.

C. L. Penny, referee, reported the results of tests by 4 analysts of the Leffmann-Beam and Reichert-Wollny methods for volatile fatty acids, and the provisional methods of the Association for albumin and casein. Incidentally the use of a reflux condenser *v.* a closed flask in saponification was also tested.

As a result of this work and on the recommendation of the referee, the Leffmann-Beam and present provisional methods were made optional, and it was prescribed that the fat should be weighed into the saponification flask from a weighing tube marked to contain 5.75 cc.

SUGAR.

The report of the referee on sugar, R. L. Hiltner, reviewed briefly the work of the Association on the subject, and gave the results of tests of methods by 7 analysts on a sample of beet molasses.

The Carr and Sanborn and the quartz-sand methods for water determination were made provisional. Creydt's method for raffinose and sucrose was also made provisional.

The secretary was directed to thoroughly revise all the methods for sugar, omitting (*b*) and (*c*) of the present official methods, and under (*e*) giving directions for the preparation of the permanganate solution used,[1] and incorporating in the methods the statement that the determination of water by means of density is not applicable to low-grade products.

H. W. Wiley called attention to the fact that efforts to secure international agreement as to methods of sugar analysis are meeting with considerable success. He therefore thought it unwise to make any radical changes in methods of sugar analysis at the present time.

TANNIN.

The referee on this subject, J. H. Yocum, reported the results of comparative tests of methods by 20 analysts on chestnut-wood extract, hemlock liquor, and an artificial tannin extract. Incidentally tests were made of 2 samples of hide powder. Numerous recommendations of the referee relating to quantity of material, directions for drying, filtration, preparation of hide powder, etc., were adopted by the Association.

MISCELLANEOUS.

The report of the abstract committee was presented by E. W. Allen, chairman. This report showed that the abstracts of literature relating to analytical methods covered 60 pages of the current volumes of the *Experiment Station Record*, beginning with Vol. 9, No. 4, and covering Vol. 10, No. 3.

A paper entitled "Report on an investigation of methods for the determination of nicotin in tobacco powders and extracts," by E. A. de Schweinitz, J. A. Emery, and F. K. Cameron, was presented to the Association. This paper reported the results of tests of different methods of determining nicotin, including Kissling's, Lloyd's, and the optical methods, with the results of special investigations by A. L. Winton and E. A. de Schweinitz and associates. Six analysts in different parts of the country took part in the comparison of methods. The results show the unreliability of the methods that are at present available for the determination of nicotin. This matter was deemed of such great importance, that the Association voted to appoint referees on the subject of insecticides and fungicides, who should be charged

[1] U. S. Dept. Agr., Division of Chemistry Bul. 46, p. 56.

with the duty of investigating such questions as those discussed in the paper.

A brief verbal report from the committee on volumetric standards was submitted by B. W. Kilgore. He recommended that no action be taken by this committee until the results of the deliberations of the International Congress at Vienna are known, but suggested that chemists in different parts of the country should make observations on the average temperature of their laboratories, with a view to deciding upon a normal temperature for the graduation of chemical apparatus. From the observations that the reporter had been able to make in two laboratories, he was inclined to believe that the normal laboratory temperature for a large part of the country was from 20 to 22°, rather than 15° C., as commonly assumed. The report of this committee was accepted and the committee was continued.

M. E. Jaffa invited the Association to hold its next meeting in California. The invitation was referred to the executive committee for consideration.

The thanks of the Association were voted the Columbian University, Cosmos Club, the Secretary of Agriculture, and the president and secretary of the Association.

OFFICERS OF THE ASSOCIATION.

Officers were elected for the ensuing year as follows: President, R. C. Kedzie; vice-president, B. W. Kilgore; secretary, H. W. Wiley; executive committee—president, vice-president, secretary, and H. J. Wheeler and M. E. Jaffa.

The referees and associate referees are as follows:

Phosphoric acid: Referee, E. G. Runyan, Washington, D. C.; associate referee, H. K. Miller, Raleigh, N. C.

Nitrogen: Referee, B. L. Hartwell, Kingston, R. I.; associate referee, Thorn Smith, Moscow, Idaho.

Potash: Referee, B. B. Ross, Auburn, Ala.; associate referee, L. S. Munson, Agricultural College, Mich.

Soils and ash: Referee, M. E. Jaffa, Berkeley, Cal.; associate referee, W. R. Perkins, Agricultural College, Miss.

Foods and feeding stuffs: Referee, G. L. Teller, Fayetteville, Ark.; associate referee, F. W. Woll, Madison, Wis.

Dairy products: Referee, J. B. Weems, Ames, Iowa; associate referee, J. A. LeClerc, Geneva, N. Y.

Liquors and food adulteration: Referee, H. A. Weber, Columbus, Ohio; associate referee, W. D. Bigelow, Washington, D. C.

Sugar: Referee, Elton Fulmer, Pullman, Wash.; associate referee, G. L. Spencer, Washington, D. C.

Tannin: Referee, O. Carr, Corry, Pa.

The abstract committee is as follows: E. W. Allen, Washington, D. C.; J. T. Anderson, Auburn, Ala.; W. H. Beal, Washington, D. C.; E. B. Holland, Amherst, Mass.; C. G. Jenter, Geneva, N. Y.; L. H. Merrill, Orono, Me.; H. Snyder, St. Anthony Park, St. Paul, Minn.; J. P. Street, New Brunswick, N. J.; and C. B. Williams, Raleigh, N. C.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

A volumetric citrate method for quick and exact determination of phosphoric acid in superphosphates, S. LITTMAN (*Chem. Ztg., 22 (1898), No. 68, pp. 691, 692*).—The method proposed is as follows: Dissolve 10 gm. of superphosphate in ½ liter of water, shake ½ hour, and filter. To 50 cc. of the filtered solution add methyl orange and run in $\frac{1}{10}$ normal soda solution until a distinct yellow color appears, showing that the free phosphoric acid, H_3PO_4, has been converted into monosodium phosphate, which reacts alkaline with methyl orange and acid with phenolphthalein. Add 10 cc. of neutral sodium citrate solution, prepared by exactly neutralizing a solution of 30 gm. of sodium hydrate in 120 cc. of water with pure concentrated citric acid, allow to stand 24 hours, filter, and dilute to 250 cc. This converts the unaltered monocalcium phosphate into monosodium phosphate. Phenolphthalein is then added, and soda solution run in until a red coloration appears, showing that the monosodium phosphate has been converted into trisodium phosphate. The number of cubic centimeters of soda solution required for this purpose multiplied by 0.71 gives the percentage of phosphoric acid.

This method and the gravimetric method were compared with very satisfactory results in a series of determinations of phosphoric acid in superphosphates made from Florida and Algerian phosphates, bone meal, and bone ash, and in spodium and mixed fertilizers. The average difference in 50 determinations by the two methods was 0.13 per cent.

On a new method of determining nitric acid, W. ACKERMANN (*Chem. Ztg., 22 (1898), No. 68, pp. 690, 691*).—The method proposed is based upon the observation made by Kuhlmann[1] that ferrous hydrate heated with a nitrate solution is transformed into black oxid with evolution of ammonia. The details of the method are as follows: Place about 1 gm. of the nitrate in a half-liter flask with 30 cc. soda solution of 1.33 sp. gr. and 40 gm. of iron sulphate dissolved in water. The volume of solution should be about 160 cc. The iron sulphate solution is prepared by dissolving 308 gm. of the sulphate in 1 liter of water.

[1] Gmelin-Kraut, 3, p. 301.

After thoroughly mixing the contents of the flask, add a small thimbleful of pulverized or reduced iron to prevent bumping, connect the flask with the condenser, and distil the ammonia into standard acid, heating cautiously at first to prevent frothing.

Method of determining nitrites in waters, L. ROBIN (*Jour. Pharm. et Chim., 6. ser., 7 (1898), No. 12, pp. 575–577; abs. in Bul. Assoc. Chim. Sucr. et Distill., 16 (1898), No. 1, pp. 83, 84*).—This method is based upon the principle that when potassium iodid and acetic acid are added to a solution containing nitrites an amount of iodin is set free which is proportional to the amount of nitrites present.

To 50 cc. of the water to be examined add 2 cc. of a 20 per cent solution of pure potassium iodid and 2 cc. glacial acetic acid, stir and allow to stand exactly one-half hour, add a small amount of starch, and titrate with a solution of sodium hyposulphite prepared by diluting 50 cc. of decinormal solution to 1 liter.

A table is given which shows the amount in milligrams per liter of nitrous acid corresponding to the number of cubic centimeters of sodium hyposulphite used when 50 cc. of the water is taken for the test.

Concerning casein and its cleavage products in peptic digestion, F. ALEXANDER (*Ztschr. Physiol. Chem., 25 (1898), No. 5–6, pp. 411–429*).—A study of the properties of casein prepared by the Hammarsten method, and of the products resulting in the fractional digestion with pepsin-hydrochloric acid.

The estimation of potash in soils, C. L. PENNY (*Delaware Sta. Rpt. 1897, pp. 146–163, figs. 3*).—See also Bulletin 36 of the station (E. S. R., 10, p. 134).

A new volumetric method for the determination of copper, R. K. MEADE (*Jour. Amer. Chem. Soc., 20 (1898), No. 8, pp. 610–613*).—The copper is precipitated as cuprous thiocyanate, changed to oxid by heating with caustic alkali, treated with an excess of ferric chlorid or sulphate with a little dilute sulphuric acid, filtered, and the filtrate titrated with permanganate. The copper reduces a corresponding amount of the iron from the ferric to the ferrous form, and the iron equivalent to the permanganate multiplied by 1.125 gives the amount of copper in the sample.

The methods for examination of milk and its products, H. TIEMANN (*Die Untersuchungsmethoden der Milch und deren Producte. Leipsic: M. Heinsius Nachf., 1898, pp. 61*).—This is intended for food chemists, and deals especially with the methods employed in the control of butter and milk.

The determination of water in butter, margarin, etc., by means of acid-butyrometry, N. GERBER and M. M. CRAANDIJK (*Milch Ztg., 27 (1898), No. 38, pp. 593–595*).—The results of 15 trials of the method, which is described, in comparison with the gravimetric results, are considered sufficiently exact for creamery and police control purposes.

The relations between the specific gravity and the insoluble fatty acids of butter and other fats, N. LEONARD (*Analyst, 23 (1898), Nov., pp. 282, 283*).—Four years ago the author found, on examination of 33 samples of butter, that the results might be represented by the formula $y = k\ (1 - x)$, in which y is the percentage of insoluble fatty acids, x the specific gravity at 100° F., and k a constant the mean value of which was found to be 951 ± 1.6. Recently 30 additional samples were examined, and k was found to have the mean value 951 ± 1.8. "This close agreement with the previous result is interesting as showing the constancy of the general character of the adulterants employed." The results obtained by calculation on the above basis and by determination of the insoluble fatty acids are given.

The determination of the Reichert-Meissl number, M. SIEGFELD (*Chem. Ztg.*, *22 (1898), No. 72, pp. 738, 739, fig. 1*).—In determining the volatile fatty acids by the Reichert-Meissl method, it is proposed to measure the 5 gm. of fat with a pipette, instead of weighing it out. In a large number of trials the amount measured in this way ranged from 4.967 to 5.045 gm., and this variation would result in an error of from 0.2 to 0.3, which the author believes to be of little account in this determination. A water bath is described for use in heating and filtering the fat at the desired temperature. This accommodates 10 samples of fat at a time.

On the determination of undigested fat and casein in infant feces, H. POOL (*Jour. Amer. Chem. Soc.*, *20 (1898), No. 10, pp. 765–769*).—Using the method previously described by the author (E. S. R., 9, p. 917), examinations were made of 34 samples, the results of which are tabulated.

Microscopic water analysis, C. MEZ (*Mikroscopische Wasseranalyse. Berlin: J. Springer, 1898; abs. in Bot. Centbl., 75 (1898), No. 1, pp. 10–12*).—Treats of the microscopic examination of drinking and drainage waters.

A study of the nitrogen contained in wine, J. LABORDE (*Ann. Inst. Pasteur, 12 (1898), No. 8, pp. 517–540*.)

The composition of æolosomine, A. B. GRIFFITHS (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 13, pp. 448, 449*).—This is a so-called respiratory proteid.

The proteid and nonalbuminoid nitrogen in straw and chaff (*Deut. Landw. Presse, 25 (1898), No. 65, p. 713*).—The total protein and nonalbuminoid nitrogen in 25 kinds of straw and chaff of cereals and legumes is given.

Miscellaneous chemical work, C. L. PENNY (*Delaware Sta. Rpt. 1897, pp. 163–165*).—Discusses very briefly tests of methods of preserving and analyzing milk samples, and reports analyses (with reference to sugar content) of 4 varieties of sorghum which had been subjected to selective propagation for several years.

Lubricants for glass stop-cocks, F. C. PHILLIPS (*Jour. Amer. Chem. Soc.*, *20 (1898), No. 9, pp. 678–681*).—A mixture of pure rubber 70 parts, spermaceti 25 parts, and vaseline 5 parts "lubricates well, is translucent, adheres to the glass, and is not saponifiable. . . . Another preparation which gave still better results was made by mixing pure rubber 70 parts and yellow unbleached beeswax 30 parts. . . . A thick rubber and wax mixture is especially suited for well-ground glass stop-cocks upon gas vessels which are to be exhausted and which have therefore to sustain the full pressure of the atmosphere. Such mixtures have been in use for stop-cocks of ordinary burettes in volumetric work during about two years, and have given satisfactory results in every way."

BOTANY.

A revision of the North American species of Calamagrostis, T. H. KEARNEY (*U. S. Dept. Agr., Division of Agrostology Bul. 11, pp. 7–42, fig. 1*).—This is a monographic revision of the North American species of Calamagrostis, together with notes on geographic distribution, ecology, teratology, and hybridism. A list is given of excluded species and an analytical key to the species recognized. The new species described by the author are: *Calamagrostis lemmoni*, *C. foliosa*, *C. angusta*, *C. subflexuosa*, *C. fasciculata*, *C. nemoralis*, *C. alaskana*, *C. laxiflora*, *C. micrantha*, *C. californica*, and *C. labradorica*. In all 38 species and a number of varieties are enumerated.

Descriptions of new or little-known grasses, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Bul. 11, pp. 42–60, pls. 17, figs. 11*).—Descriptions are given with reference to habitat, etc., of a number of new or poorly known species of grasses.

Those described as new are: *Panicum linearifolium*, *P. equilaterale*, *P. implicatum*, *P. wrightianum*, *Chætochloa latifolia*, *Stipa williamsii*, *S. nelsoni*, *S. minor*, *Muhlenbergia palustris*, *Sporobolus palmeri*, *S. thurberi*, *S. simplex*, *Agrostis paludosa*, *Trisetum argenteum*, *Zeugites pringlei*, *Eragrostis viscosa*, *Poa capillaris*, *P. juncifolia*, *P. hanseni*, *P. atropurpurea*, *P. longipedunculata*, *Agropyron elmeri*, *A. brevifolium*, *Elymus capitatus*, *E. hanseni*, and *E. ciliatus*. *Elymus saxicolus* Scribner and Smith and *E. simplex* Scribner and Williams are also described. In addition to the above a few new combinations are given as a result of changes in nomenclature.

The principal poisonous plants in the United States, V. K. CHESNUT (*U. S. Dept. Agr., Division of Botany Bul. 20, pp. 60, figs. 34*).—The author has given concise and illustrated descriptions of many of our most common poisonous plants, the number considered embracing about 50 species. The arrangement of the plants is according to the scientific classification at present most generally accepted, but by the liberal use of common names and a brief outline of geographic distribution any of the species would be easily recognized. The following are the species enumerated: Fly amanita (*Amanita muscaria*), death cup (*A. phalloides*), American false hellebore (*Veratrum viride*), lily-of-the-valley (*Convallaria majalis*), showy lady's slipper (*Cypripedium reginæ*), larger yellow lady's slipper (*C. hirsutum*), smaller yellow lady's slipper (*C. parviflorum*), corn cockle (*Agrostemma githago*), aconite (*Aconitum columbianum*), larkspurs (*Delphinium tricorne*, *D. geyeri*, *D. menziesii*, *D. recurvatum*, and *D. trolliifolium*), black cherry (*Prunus serotina*), Kentucky coffee tree (*Gymnocladus dioica*), woolly loco weed (*Astragalus mollissimus*), stemless loco weed (*Aragallus lambertii*), rattlebox (*Crotalaria sagittalis*), caper spurge (*Euphorbia lathyris*), snow-on-the-mountain (*E. marginata*), poison ivy (*Rhus radicans*), poison oak (*R. diversiloba*), poison sumac (*R. vernix*), red buckeye (*Æsculus pavia*), water hemlock (*Cicuta maculata*), Oregon water hemlock (*C. vagans*), poison hemlock (*Conium maculatum*), broad-leaf laurel (*Kalmia latifolia*), narrow-leaf laurel (*K. angustifolia*), great laurel (*Rhododendron maximum*), stagger-bush (*Pieris mariana*), branch ivy (*Leucothöe catesbæi*), false jessamine (*Gelsemium sempervirens*), Jimson weeds (*Datura stramonium*, and *D. tatula*), black nightshade (*Solanum nigrum*), bittersweet (*S. dulcamara*), spreading nightshade (*S. triflorum*), and sneezeweed (*Helenium autumnale*).

Hybrids and their utilization in plant breeding, W. T. SWINGLE and H. J. WEBBER (*U. S. Dept. Agr. Yearbook 1897, pp. 383–420, pls. 1, figs. 13*).—The authors have given a statement concerning hybrids and their utilization in plant breeding, most of the information being compiled. Hybrids are defined and the methods of producing them are fully explained. Notes are also given on plants which may be hybridized and the effect of the different crossings on the hybrid progeny.

A grouping of hybrids is given according to their resemblance to their respective parents. The descendants of hybrids, the difference between reciprocal hybrids, prepotency of pollen from one plant to another, increased vigor of hybrids and cross-bred plants, direct action of foreign pollen on the mother plant, and graft hybrids are discussed.

The practical utilization of hybrid plants in plant breeding is discussed at considerable length and some of the special features obtained by hybridizing pointed out.

Chlorophyll assimilation in littoral plants, E. Griffon (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 13, pp. 449–452*).—The author has made a study of the plants which are characteristic of the flora along the seashore and are also found growing in saline soils in the interior. Specimens were collected under the same conditions both from the littoral flora and from the interior of France and examined microscopically, the following species being used: *Atriplex hastata*, *Beta maritima*, *Lycium barbarum*, *Plantago major*, *Tussilago farfara*, *Senecio vulgaris*, *Polygonum aviculare*, and *Medicago lupulina*. From his investigations it is stated that maritime plants, while undergoing a reduction in the amount of chlorophyll, due to the marine salts, have acquired a greater thickness and marked increase in the assimilating tissue; but this modification of structure is not able to entirely overcome the action produced by the salts. Assimilation in proportion to a unit of leaf surface is less in leaves of littoral plants than the same species growing in the interior.

Influence of light on the form and structure of plants, Maiga (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 11, pp. 420–423*).—The author has made a study of the influence of light on the branching of *Ampelopsis hederacea* and *Glechoma hederacea*. Both of these plants possess flowering and climbing or running branches that are quite dissimilar. In each case the flowering branches have very short internodes and the leaves are crowded toward the summit, while the climbing and running branches are characterized by a very rapid growth and elongated internodes. The plants were grown under a number of different conditions of illumination, and it was found that diffused light favors the formation of climbing or running branches and is able to transform the flowering buds into climbing or running ones. It also exerts a marked influence in changing the morphological and anatomical characters which are characteristic of climbing or running branches. Direct illumination produces the opposite effect.

Influence of mutilating seed on the development of the plants, E. Gain (*Proc. Assoc. Franc. l'Avancement Sci. 1897, pp. 463–468*).—The author gives an account of experiments conducted with seed of lupines to test the effect of removing one or both cotyledons on the growth and development of the plants. The seeds were soaked for 40 hours and comparable lots were selected and planted in pots in which the soil was the same. After 12 days the young plants were divided into three

groups, one of which had both cotyledons removed, another had one removed, while the third lot developed in the normal way. The author describes the effect of this treatment on the growth and the morphological characters of the different plants. The mutilation of cotyledons was found to retard the growth, reduce the number of leaves as well as the number and size of the leaflets, and greatly modify the general habit of growth of the plants. In the case of those in which both cotyledons were removed the plant developed in the form of an inverted cone, while the normal plant has a tendency to a more cylindrical shape. The normal plant has usually 7, rarely 5 or 6, leaflets, while with those plants which had both cotyledons removed, 5, and sometimes 4, leaflets was the rule. The author states that this experiment will have an important bearing in showing the possible influence of the mutilation of seeds by weevil, etc.

The physiological function of iron in plants, J. STOKLASA (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 5, pp. 282, 283*).—The author states that it having been shown by Gautier and Molisch that iron is not found in chlorophyll, and that his own experiments show it does not exist in the chlorolecithin, he has been led to investigate the possible relation of iron with the cell nucleus. From onion bulbs he has succeeded in isolating a substance that in chemical composition almost exactly agrees with the hematogen which Bunge has extracted from the yolk of eggs. The author has compared the various properties of the two substances and finds them practically identical. He states that chemical and microscopical observations show that a great part of the iron in plants is localized in the embryo or endosperm, and during germination it is employed by the plant in forming nuclei of the cells of the growing tissues. The effect of depriving young plants of iron can be readily shown with cultures of maize, in which the plant quickly perishes if from the nutritive solution iron be omitted. It is stated that it is impossible to extract hematogen from starved plants. Plants without chlorophyll are said to act in the same way, as shown in the case of *Mucor mucedo*, and hematogen has been isolated from the common *Boletus edulis*. The author concludes from his investigations that iron as well as phosphorus plays an important rôle in the formation of the cell nucleus.

A revision of the genera Chloris and Eustachys in North America, G. V. NASH (*Bul. Torrey Bot. Club, 25 (1898), No. 8, pp. 432–450*).—According to the author, as revised, the species of Chloris known to North America are 10 and those of Eustachys 4.

New species of Alabama fungi, C. H. PECK (*Bul. Torrey Bot. Club, 25 (1898), No. 7, pp. 368–372*).—As a contribution from the Alabama Biological Survey, the author describes 10 species of fleshy fungi.

American grasses, I, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Bul. 7, pp. 331, figs. 302*).—A revised edition of this bulletin (E. S. R., 9, p. 327).

New plants from Wyoming, A. NELSON (*Bul. Torrey Bot. Club, 25 (1898), No. 7, pp. 373–381*).—This is the third contribution of the author descriptive of noteworthy species of plants in Wyoming, and contains descriptions and notes of 14 new species.

Some brief notes on the Swedish plant improvement investigations at Svalöf, N. H. NILSSON (*Malmö (Sweden), 1898, pp. 14. In German*).

Native poison plants, A. MORRISON (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 3, pp. 214–218, figs. 4*).—Descriptive notes are given of the following plants, which are reputed as being poisonous to cattle: *Oxylobium retusum, Gastrolobium callistachys, G. parvifolium,* and *G. trilobum.*

The poison plants of Western Australia, A. MORRISON (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 3, pp. 572–592*).—Notes are given on various poisonous plants, the most of which belong to the two genera Gastrolobium and Oxylobium. All of these plants are poisonous to stock, and methods for their eradication are suggested.

Homology of the members of the plant body, with special reference to the question of homology involved in the alternation of generations in green plants, F. O. BOWER (*Gard. Chron., 3. ser., 24 (1898), No. 612, p. 224*).—A brief résumé is given of the presidential address of the author before the Botanical Section of the British Association at its meeting September 8, 1898.

The number and symmetry of the fibrovascular bundles in the petiole as a character in determining species, A. CHATIN (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 6, pp. 301–307*).

Origin of lenticels, H. DEVAUX (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 20, pp. 1432–1435*).—The author gives a report on the origin of the structures forming lenticels.

The nature and origin of stipules, A. A. TYLER (*Ann. New York Acad. Sci., 10 (1898), No. 1–12, pp. 1–49, pls. 2*).

The splitting of fruits and tubers (*Gard. Chron., 3. ser., 24 (1898), No. 611, p. 198*).—Editorial notes are given on the physiological causes which result in the splitting of various fruits and tubers.

Concerning some caryophyllaceous hybrids, K. FRITSCH (*Oesterr. Bot. Ztg., 48 (1898), No. 10, pp. 381–385*).—Hybrids between species of Saponaria and of species of Gypsophila are described.

The insect visitors of flowers, J. H. LOVELL (*Bul. Torrey Bot. Club, 25 (1898), No. 7, pp. 382–390*).—The author has given descriptions of the methods for fertilization of various flowers and the insect visitors of *Gaultheria procumbens, Chelone glabra, Impatiens biflora, Cornus canadensis, C. stolonifera, C. alternifolia,* and *Aralia racemosa.*

Sex in plants, J. HOOPES (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 665–678, figs. 10*).—A reprint of Pennsylvania Dept. Agr. Bulletin 30 (E. S. R., 9, p. 812).

A permanent stain for starch, J. H. SCHAFFNER (*Jour. Appl. Micros., 1 (1898), No. 10, p. 181*).—By the use of anilin-safranin and gentian-violet a permanent stain may be secured.

On the preservation of materials in paraffin, C. JANET (*Bul. Soc. Zool. France, 23 (1898), No. 7–8, pp. 117, 118*).

Plant physiological and agricultural-chemical researches during 1897, H. JENSEN (*Tidsskr. Landökon, 17 (1898), No. 3–4, pp. 314–331*).

FERMENTATION—BACTERIOLOGY.

A preliminary arrangement of the species of the genus Bacterium, F. D. CHESTER (*Delaware Sta. Rpt. 1897, pp. 53–145*).—The author proposes a scheme for the description of bacteria, which is thought to be sufficient in detail for the identification of the different species. A table is given in which the name, synonyms, habitat, and morphology of 354 species of Bacterium are given, together with their staining peculiarities, temperature conditions, description of their appearance in gelatin and agar cultures, gelatin stab, and slant cultures, agar cultures, potato cultures, bouillon cultures, milk cultures,

litmus-milk cultures, and pepton-rosolic acid solution, are described, together with their action in fermentation tubes, chemical relations, and pathogenesis.

In an appendix 10 species of bacteria associated with diseases of plants are briefly noted, which the author claims are not sufficiently described or are of such a habit as to make their classification by the foregoing scheme impossible.

The work concludes with an index of the more important literature of species of the genus Bacterium.

Bacteriological examination of drinking water, F. D. CHESTER (*Delaware Sta. Rpt. 1897, pp. 42–53*).—During the past year a considerable portion of the bacteriologist's time has been taken up with the examination of different samples of drinking water. The different methods of examination are reviewed and the method of Smith[1] is given in some detail. This method consists practically of the following manipulations: To each of a series of 10 fermentation tubes containing 1 per cent glucose bouillon, are added quantities of water varying from 0.1 to 1 cc., and are kept at 37 to 38° C. If after 3 or 4 days one or more of the tubes are found to contain from 40 to 60 per cent of gas, and if the reaction of the liquid is strongly acid, the presence of the colon bacillus is regarded as certain. In the author's experience this method is not wholly accurate, and details are given of several cultures showing that the appearance of the colon bacillus can only be certainly established by isolating the organism and by its cultural characteristics. The claim that the above-described method of treatment gives absolute results the author thinks should be qualified to mean the possible evidence of the presence of this particular germ.

A simple steam sterilizer, F. G. NOVY (*Jour. Appl. Micros., 1 (1898), No. 2, p. 33, fig. 1*).

An atlas of bacteriology, C. SLATER and E. J. SPITTA (*London: Scientific Press, 1898.*)

Laboratory methods in bacteriology: Detection of pathogenic organisms, F. G. NOVY (*Jour. Appl. Micros., 1 (1898), No. 10, pp. 175–178, figs. 2*).

Laboratory directions for beginners in bacteriology, V. A. MOORE (*Ithaca, 1898, pp. VI+89*).

A practical guide to the bacteriological analysis of pus, blood, saliva, milk, urine, water, soil, etc., L. FELTZ (*Guide pratique pour les analyses de bacteriologie clinique, pus, sang, crachat, lait, urine, eau, sol, etc. Paris: J. B. Baillière, 1898, pp. 282, figs. 111*).

Technical mycology: The utilization of micro-organisms in the arts and manufactures, F. LAFAR. Transl. by C. I. C. SALTER (*Philadelphia: J. B. Lippincott Co., 1898, Vol. I, pp. IX+405, pl. 1, figs. 90*).—This valuable contribution is a practical handbook on fermentation and fermentative processes for the use of brewers, distillers, analysts, technical and agricultural chemists, pharmacists, and all interested in the industries dependent on fermentation. The first volume, the only one at hand, treats solely of schyzomycetic fermentation. The immense strides that mycology has made in the arts are seldom appreciated until such a work as the present volume is carefully examined.

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[1] Centbl. Bakt. u. Par., 1, Abt., 18 (1895), p. 494.

A few of the many topics discussed are distilling, brewing, wine making, manufacture of vinegar, dairying, preparation of fodders of various kinds, tobacco and sugar manufacturing, fixation of free atmospheric nitrogen, nitrification, etc. The subjects have been treated from the botanical, technical, and chemical standpoints, particular stress being paid to the latter two. Special sections are devoted to the decomposition and transformation of organic nitrogenous compounds and on oxidizing fermentation, in which a large fund of information is given relative to the bacterial processes involved in the breaking up of various organic compounds.

The historical development of the subject is treated in a very interesting and complete manner and the account of the various systems of classification of bacteria is most valuable. The principles of sterilization and pure cultivation are rather briefly but very clearly stated.

Mechanically the book is well made, and the only serious fault to be found with it is the lack of an index, a serious omission we believe in any work. This will doubtless be given in the concluding volume, but in such a work its usefulness is greatly increased by making every volume, complete in itself. The same objection can be offered the system of references. A very complete table of contents will aid somewhat in overcoming the difficulties experienced by the lack of an index. In all probability this work will for sometime to come be the most elaborate and useful treatise in English on the subject.

ZOOLOGY.

Birds that injure grain, F. E. L. BEAL (*U. S. Dept. Agr. Yearbook 1897, pp. 345–354*).—According to the author the more important grain-eating birds in the United States are the crow, crow blackbird, red-winged blackbird, yellow-headed blackbird, rusty grackle, and cowbird. The food habits, breeding places, etc., of the different birds are noted as well as the causes which account for the increase of some of the birds. It is stated that apparently few birds willingly subsist exclusively upon any one kind of grain for a considerable time, and on the other hand they have a marked fondness for the seeds of certain useless plants. The ravages which they occasionally cause are explained on the ground of too many birds of the same or closely allied species within a limited area. An attempt to exterminate the species is regarded as ill advised and hopeless. It would doubtless be possible to diminish the number of birds when desirable.

"With the breeding places more restricted and an environment otherwise changed by increased population, the number of birds must surely decrease, and in time the proper equilibrium will be restored. In the meantime it behooves the farmer to apply such remedies as the exigencies of the case suggest, and where these gregarious species are over abundant it might be well to exempt them from the general protective laws, in order that each landholder may be free to protect himself as best he can."

Further notes on the birds of Colorado, W. W. COOKE (*Colorado Sta. Bul. 44, pp. 147–176*).—This is considered as an appendix to Bulletin 37 of the station (E. S. R., 9, p. 229), and contains notes on the results of investigations made since the former bulletin was published. The total number of birds now known to occur in Colorado is 374, of which 236 breed there.

The white or barn owl (*Bd. Agr. [London] Leaflet No. 51, pp. 4, fig. 1*).—The white or barn owl (*Strix aluco* or *S. flammea*) is described, and information concerning its food habits, etc., quoted from a number of sources. The fact is pointed out that this bird is useful and that it should be protected. The wild birds' protection act, which applies to the white or barn owl, is cited.

On the systematic destruction of woodchucks, F. H. STORER (*Bul. Bussey Inst., 2 (1898), No. 7, pp. 423–428*).—The author discusses attempts to destroy woodchucks with vapor from volatile liquids, such as bisulphid of carbon, and by poisons. Experiments in smoking woodchucks in their burrows are reported. Earlier attempts were made with sulphur or touch paper, but the best results were obtained with a torch made of sodium nitrate 12 parts, sulphur 6 parts, mealed gunpowder 4 parts,

antimony sulphid 2 parts. The author also quotes a method of destroying woodchucks by exploding cartridges of common blasting powder or dynamite in the burrows.

The determination and regulation of sex, SCHILLER (*Milch Ztg., 27 (1897), No. 37, pp. 580–582*).—The author summarizes some of the principal investigations on the determination of sex in animals and compares it with recent work with men along the same lines.

Microtechnique of animal morphology; a critical description of microscopical experimental methods, APÁTHY (*Die Mikrotechnik der tierischen Morphologie. Eine kritische Darstellung der mikrokopischen Untersuchungsmethoden. Braunschweig: H. Bruhn. 1896, pt. 1, pp. 320, figs. 10; rev. in Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 2–3, pp. 100, 101*).

On a green leucocytosis in oysters associated with the presence of copper in the Leucocytes, R. BOYCE and W. A. HERDMAN (*Proc. Roy. Soc. [London], 62 (1897), No. 379, pp. 30–38*).—The authors report a number of experiments. Copper was found in green oysters in much larger quantity than in white oysters.

METEOROLOGY.

Report of the meteorologist, W. H. BISHOP (*Delaware Sta. Rpt. 1897, pp. 214–229*).—Monthly summaries of observations at 6 different places in Delaware on temperature, atmospheric pressure, and precipitation during the year ending June 30, 1897, and a summary of observations on temperature and precipitation during the calendar year 1896 are given and the data briefly discussed.

The summary for 1896 is as follows:

Annual summary of meteorological observations in Delaware.

Locality.	Temperature. Highest.	Temperature. Lowest.	Temperature. Mean.	Total rainfall.	No. days on which 0.01 in. or more of rain fell.
	Deg. F.	Deg. F.	Deg. F.	Inches.	
Newark	98	0	52.24	31.13	96
Middletown	100	2	53.20	36.55	83
Dover	98	6	54.11	41.85	83
Milford	98.5	9	56.02	46.48	88
Seaford	97	6.5	54.98	47.98	93
Millsboro	98	6	54.44	44.74	111

Rainfall of the crop season, A. J. HENRY (*U. S. Dept. Agr. Yearbook 1897, pp. 607-618, charts 5*).—Tables and charts show the monthly and seasonal averages of rainfall, April to September, of the different States and Territories; the averages and least rainfall of the region east of the one hundredth meridian; variations in rainfall; and date of appearance of first and last killing frost. The data are briefly discussed.

The mean annual rainfall of the globe, R. DEC. WARD (*Science, n. ser., 8 (1898), No. 198, pp. 507, 508*).—This article briefly discusses Loomis and Supan's rainfall maps, Symon's report on "British rainfall in 1897," Todd's report on "Rainfall in South Australia and the Northern Territory, and that portion of the bibliographical number (for 1897) of *Annales de Geographie* which contains notes on climatology and meteorology.

Meteorology in Denmark, 1896–97, V. WILLAUME-JANTZEN (*Tidsskr. Landökon., 17 (1898), No. 1–2, pp. 88–101*).

AIR—WATER—SOILS.

Some interesting soil problems, M. WHITNEY (*U. S. Dept. Agr. Yearbook 1897, pp. 429–440*).—This is a discussion of the peculiar physical properties of certain soils of the extreme West which "absorb moisture so readily, lose it through evaporation so slowly, and yet supply the needs of plants so regularly and abundantly that they can stand long periods of drought, during which the crops continue to grow without any signs of suffering for lack of water."

Certain soils in the San Joaquin Valley, California, in the region of Tulare and Fresno, seem to have a remarkable power of transporting water for the use of crops. Less than 10 in. of rain falls during the year and none falls during the growing season, and standing water is probably 12 to 25 ft. below the surface; yet good crops are grown without irrigation provided the irrigation canals are allowed to run, the seepage apparently supplying in some unexplained way the water needed. "At . . . Chino, San Bernardino, Claremont, and Pomona there are certain soils upon which crops are grown without irrigation. There are on an average between 17 and 18 in. annual rainfall at these places, the most of which falls during the winter months. Less than an inch of rain falls on the average during the 5 months of the growing season, from May to September, inclusive." This is an artesian district, but the surface wells are from 20 to 40 ft. deep.

Similar conditions have been noted elsewhere in the region of deficient rainfall, notably "in the great wheat areas in the northern part of the San Joaquin Valley of California, in the Palouse district around Pullman, Washington, and on the foothills at Wallawalla, Washington, and at Bozeman, Montana, where there are soils which produce fine crops of wheat without irrigation," although the rainfall amounts to from 13 to 18 in. and most of it falls during the winter months, and ground water is from 30 to 40 ft. below the surface.

Soils of the Mohave desert with 3 in. annual rainfall, of which only 0.3 in. falls in the season from May to September, were examined about the middle of September, "at least 20 miles from the mountains, in the midst of a level plain."

"Contrary to expectation, the soil at a depth of from 12 to 18 in. below the surface was still quite moist, in spite of the fact that no rain had fallen for at least 5½ months. The surface wells vary in depth from 6 to 30 ft., occasionally being 200 ft. deep. On certain parts of the desert it is the common practice to dig holes 6 to 10 ft. deep and allow them to fill up with water for the use of the stock. The distance to water varies according to the nature of the soil, just as it does in the humid portions of the country. The soils in which the water is close to the surface are, as a rule, impregnated with alkali. There is an artesian belt under a portion of the desert.

"Investigation showed the same conditions to exist on the Nevada and Utah deserts between Reno and Ogden. The annual rainfall is between 5 and 6 in., the seasonal rainfall about 1 or 2 in. on the average. It is stated that water can be found on these deserts about 30 ft. below the surface, although the water may be so strongly impregnated with salts that it is unfit for use. . . .

"A fact which makes more remarkable this extraordinary power of the soils to absorb and retain a sufficient quantity of water for the needs of crops for 5 or 6 months after the rain ceases is the very low relative humidity of the atmosphere. Records of the relative humidity have been taken from only a few of the places under consideration, and these are given in the following table:

Mean annual and seasonal relative humidity.

Locality.	Annual.	May to September.	July and August.
	Per cent.	*Per cent.*	*Per cent.*
Tulare, Cal	58	42	35
Wallawalla, Wash	62	47	39
Miles City, Mont	65	52	46
Bismarck, N. Dak	72	67	65
Humboldt, Nev	48	36	31

"The mean relative humidity of New England for July and August, 1897, determined from the reports of 7 Weather Bureau stations, was 85 per cent. At Wallawalla the mean relative humidity from May to September was only 47 per cent and for July and August 39 per cent. It is hardly conceivable that under these extremely dry conditions the foothills soil could maintain sufficient water from the winter rains to supply the loss due to evaporation from the surface of the soil and to transpiration by the plant for months after the rain had ceased to fall. At Tulare the mean relative humidity during the growing season is 42 per cent and 35 per cent during the months of July and August—conditions which practically prevail at Fresno. Nevertheless, at Fresno, with nearly the same rainfall, and where crops must transpire great quantities of moisture into the dry atmosphere, the soil maintains an adequate supply of moisture for the plants, provided the water continues to run in the canals, although these may be as much as a mile apart. . . .

"At Humboldt, on the Nevada desert, the relative humidity from May to September is about 36 per cent and in July and August 31 per cent. The conditions over the Mohave desert are probably not dissimilar from those at Humboldt and Tulare."

These peculiar soil conditions suggest the importance of study of "the great power these soils have of retaining moisture and of supplying it rapidly and regularly to the crops as it is needed. If such power can be imparted to other soils of a droughty character, especially to our soils in the East, it will be of immense value to the farmer.

"The first question to solve is the distribution of the rainfall. It is important to determine the depth to standing water; that is, the average depth of wells. Then it is very important to know whether any portion of the rainfall passes down into this stratum and runs off into the drainage." The use of the electrical method for this purpose is explained.

It is important to know whether the annual rainfall in these soils descends low enough to form any connection with the underground drainage water, and if it does not, whether the small amounts of rainfall occurring during the winter months in these regions are "sufficient to maintain crops for 5 or 6 months of dry weather," with "a low relative humidity and often high temperature of the atmosphere, without any additional water supply from any source."

Tables give the mean annual and seasonal rainfall at 48 places in the regions referred to and mechanical analyses of 14 samples of soils from the same region. The composition of these soils is as follows:

Mechanical analyses of soils.

Locality.	Description.	Moisture in air-dry sample.	Organic matter.	Gravel (2-1 mm.).	Coarse sand (1-0.5 mm.).	Medium sand (0.5-0.25 mm.).	Fine sand (0.25-0.1 mm.).	Very fine sand (0.1-0.05 mm.).	Silt (0.05-0.01 mm.).	Fine silt (0.01-0.005 mm.).	Clay (0.005-0.0001 mm.).
		P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Mapleton, N. Dak	Red River Valley.	7.84	7.72	0.03	0.07	0.18	0.94	11.51	25.94	6.06	38.00
Jamestown, N. Dak.	Prairie	4.48	4.33	.86	2.10	6.37	16.69	21.70	14.57	2.75	25.55
Bismarck, N. Dak	Sandy prairie	2.54	6.02	1.74	6.61	10.67	4.23	28.91	21.17	1.79	16.48
Steele, N. Dak	Prairie	4.46	5.18	0.00	.09	.42	1.87	41.18	22.97	3.58	19.57
Billings, Mont	do	2.98	4.40	0.00	0.00	.16	7.96	28.79	34.45	4.67	17.25
Pullman, Wash	Palouse district—basalt.	5.51	5.08	.03	.16	.16	.85	27.94	35.80	5.77	18.57
Wallawalla, Wash	Valley land	4.12	3.08	0.00	.15	.41	3.22	35.24	37.73	3.54	12.63
Do	Foothills soil	3.95	5.66	0.00	.06	.08	1.05	25.12	42.12	4.24	17.50
Fresno, Cal	Sandy loam	1.61	2.52	.43	3.40	16.14	30.95	15.90	12.72	1.58	14.60
Visalia, Cal	Loam	2.85	5.85	.03	.18	.61	5.41	34.28	34.28	3.50	14.20
Tulare, Cal	Alkali land	2.72	4.44	.64	2.57	6.22	12.46	22.79	21.36	6.51	21.05
Pomona, Cal	Sandy land	1.00	1.94	6.03	10.11	17.26	21.92	20.98	13.13	1.93	5.33
Lancaster, Cal	Mohave desert	1.77	3.81	.34	.89	1.67	7.86	35.12	28.43	3.45	18.63
Tecoma, Nev	Nevada desert	3.17	6.43	.07	.13	.37	5.24	44.96	17.94	5.00	17.93
Average		3.50	4.75	.73	1.89	4.33	8.62	28.17	25.90	3.88	18.37

Lavas and soils of the Hawaiian Islands, W. MAXWELL ET AL. (*Honolulu: Hawaiian Gazette Company, 1898, pp. 186, pls. 4, map 1*).—This is an account of investigations[1] by the Hawaiian Experiment Station and Laboratories published by order of the Hawaiian Sugar Planters' Association. The subjects studied were (1) origin and nature of Hawaiian soils and (2) availability and loss of the elements of plant food in Hawaiian soils.

Origin and nature of Hawaiian soils.—"The soils of these islands are derived from volcanic lavas. Among Hawaiian lavas are those which have been discharged from craters, flowing and cooling into rocks having the composition of normal basalts. Others, originally of the same composition, have undergone such alteration that they now compose masses having a radically different chemical composition and color appearance. This alteration took place at the time of ejection, and under the action of chemical causes, and previous to the later action of secondary causes of rock disintegration, such as weathering, which has apparently been the only agent of decomposition of certain of the normal lavas."

The results are reported of detailed chemical studies of the undecomposed lavas and of those which have undergone more or less change by weathering or under the influence of steam and sulphurous vapors. The processes of decomposition of lava under the influence of steam and sulphurous vapors were studied in the craters of Kilauea and other volcanoes. The changes which the lavas have undergone in the process of transformation into soils are shown by the following comparison of

[1] For account of previous investigations on soils see E. S. R., 7, p. 937.

the composition of unaltered lavas with the average of about 600 soils derived from them (calculated to the basis of mineral matter):

Average composition of Hawaiian lavas and soils.

	Silica.	Ferrous and ferric oxids.	Aluminum oxid.	Calcium oxid.	Magnesium oxid.	Sodium oxid.	Potassium oxid.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Hawaiian lavas	47.90	13.36	18.23	8.99	6.05	2.20	1.50
Hawaiian soils	27.54	36.45	22.64	.46	1.07	1.19	.62

On the basis of the studies made the soils of the islands are classified geologically as follows:

"(1) *Dark red soils* formed by the simple weathering of normal lavas, in climatic conditions of great heat and dryness.

"(2) *Yellow and light red soils* derived from lavas that underwent great alteration under the action of steam and sulphurous vapors at the time of or after emission from the craters.

"(3) *Sedimentary soils* derived from the decomposition of lavas at higher altitudes and removal and deposition by rainfall at lower levels.

"In addition to the classification based on geological differences in the lavas the soils have been further considered in classes dictated by the results of climatic conditions as follows:

"(1) *Upland soils* formed under lower temperatures and greater rainfall, and distinguished by a large content of organic matter and nitrogen and by a low content of the elements of plant food in an available state, these elements having been removed by rainfall.

"(2) *Lowland soils* formed under higher temperature and smaller rainfall, and characterized by a lower content of organic matter and nitrogen and by a higher content of the elements of plant food in a state of immediate availability, which is due in part to the receipt of some soluble constituents from the upper lands and to a smaller rainfall over the lower levels."

The composition of some of these soils is shown in the following table, which gives the average of over 1,300 analyses. The mineral constituents reported were determined by digesting the soils in hydrochloric acid of 1.115 specific gravity for 10 hours in a boiling water bath.

Composition of different classes of Hawaiian soils.

	Dark-red soils.	Yellow and light-red soils.	Lowland soils.	Upland soils.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Insoluble matter	37.202	24.204	35.150	27.870
Moisture	6.160	10.480	9.031	12.290
Combustible matter	11.330	20.440	15.460	20.600
Titanic oxid	2.589	3.200	1.780	1.840
Phosphoric acid	.193	.409	.396	.470
Sulphuric acid	.310	.180	.234	.157
Carbonic acid	.180	.250	.290	.030
Ferric oxid	22.942	28.720	19.980	21.810
Aluminic oxid	16.838	9.891	16.155	13.621
Calcium oxid	.344	.148	.390	.294
Magnesium oxid	.437	.745	.802	.610
Manganese oxid	.420	.435	.187	.187
Potassium oxid	.386	.378	.286	.272
Sodium oxid	.752	.621	.355	.391
Total	100.083	100.101	99.681	99.953
Insoluble silica (calculated to mineral matter)	11.449	11.492	12.569	14.068
Soluble silica (calculated to mineral matter)	20.000	12.141	16.049	13.042
Total nitrogen	.179	.459	.291	.490
Nitrogen soluble in 3 per cent KOH in 30 hours	.106	.360	.204	.347
Nitrogen insoluble in 3 per cent KOH in 30 hours	.073	.099	.087	.143
Water absorptive power	63.300	77.000	....	....

The following table compares the composition of two of the above soils with that of the lavas from which they were derived:

Comparison of lavas and soils.

	Silica.	Ferric oxid.	Alumi-num oxid.	Calcium oxid.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Normal lavas (solid)	47.58	15.02	19.92	8.88
Normal lavas (weathering)	40.35	20.52	25.23	8.11
Dark-red soils	31.45	29.78	26.94	.57
Tufa lavas	32.84	33.92	29.11	1.74
Yellow and light-red soils	23.63	43.11	18.33	.37

The analyses show that Hawaiian soils are strongly basic. As a rule the dark-red soils and the sedimentary soils are distinguished by a greater and more permanent fertility than the yellow or light-red soils.

"A comparison of American rocks with Hawaiian lavas, and of the soils respectively derived from them, have shown that the soils of these islands are totally different in type from the soils of the United States, which is set forth by the great differences in physical properties and chemical composition. Relatively speaking, the soils of these islands are in their youth, and the soils of the United States and of Europe in a state of old age."

Availability and loss of the elements of plant food in Hawaiian soils.—For the purpose of ascertaining the availability of the fertilizing constituents in Hawaiian soils the solubility in water and in 1 per cent citric acid of the lime, potash, and phosphoric acid in samples of 30 typical soils was determined.

"In the estimation of elements soluble in water 200 gm. of the field sample (not fine earth) was put into a closed funnel, with a ground-glass cover, and treated with 1,000 cc. of water for 48 hours, the water percolating through slowly, and then returned upon the soil and continued for the time stated.

"In determining the elements soluble in 1 per cent citric acid solution 200 gm. of the field sample was put into a 2-liter bottle with 1,000 cc. of the 1 per cent citric acid solution; the bottle was gently shaken every 15 minutes during the day portion of 24 hours, and at the end of this time filtered off."

The average results in percentages and pounds per acre are as follows:

Solubility of soil constituents in water and in 1 per cent citric acid.

	Soluble in water.	Soluble in citric acid.
Upland soil:	*Per cent.*	*Per cent.*
Lime	0.0032	0.0940
Potash	.0031	.0250
Phosphoric acid	.0001	.0035
Lowland soil:		
Lime	.0054	.1330
Potash	.0047	.6380
Phosphoric acid	.0003	.0046

"By far the most striking result from the action of a 1 per cent solution of citric acid upon the soil is the enormous proportion of the lime and also of the potash dissolved."[1]

[1] In connection with the tests of availability of the fertilizing constituents in the soils a series of observations was made on the relative sensibility of plants to acidity in soils, an account of which has already been given (E. S. R., 10, p. 128).

The conclusion was reached from this work that "the use of a 1 per cent solution of citric acid does not assist us very materially more than concentrated hydrochloric acid in actually reaching a duplication of the measure of solvent activity proceeding in nature, nor thus in estimating the proportion of the soil elements that are immediately available as plant food."

It was believed that the use of weaker solvents acting for longer periods would give more satisfactory results. After various preliminary tests the following method was adopted:

"Exactly 200 gm. of soil was put into the ordinary 2-liter acid bottles, having ground-glass stoppers, and 200 cc. of the solvent added. This volume was found to be just enough about to saturate and immerse the soil, without any great excess of the solvent solution being present, which was guarded against.

"Twenty bottles were taken and charged with 200 gm. of soil and 200 cc. of solvent, as already stated. Ten of these bottles were given to observations on upland (mauka) soils, and the remaining 10 bottles to corresponding observations on lowland (makai) soils.

"Each series of 10 bottles was further divided into 2 groups of 5 bottles each. The one group was to furnish data setting forth the results of the continued action of a $\frac{1}{10}$ per cent solution of [citric] acid, and the second group of a $\frac{1}{50}$ per cent solution of acid upon the same soil. . . . One bottle from each of the 4 groups, containing 5 bottles each, was selected for testing and controlling the acidity of the bottles in the 4 groups. . . .

"The control of the acidity of the solutions was made by the use of a $\frac{1}{300}$ normal solution of sodic hydrate. Every fourth day 25 cc. of solution was drawn with a pipette from each of the 4 'test bottles' and the remaining acidity of the solution determined, when enough citric acid was added to restore the acidity of the solutions in each bottle in all the groups to the original strength."

The results obtained by this method are given in the following table:

Solubility of constituents of upland and lowland soils in water and in citric acid of different strengths.

	Calcium oxid.	Potassium oxid.	Phosphoric acid.	Ferric and aluminic oxids.	Silica.
UPLAND SOILS.					
In $\frac{1}{10}$ per cent citric acid:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
12 days	0.0131	0.0132	0.0008	....	....
33 days	.0257	.0264	.0008	....	....
78 days	.0240	.0181	.0019	0.1089	....
103 days	.0202	.0175	.0028	.0878	0.0046
In $\frac{1}{50}$ per cent citric acid:					
12 days	.0097	....	.0008	....	....
33 days	.0136	.0223	.0009	....	....
78 days	.0129	.0146	.0011	.0279	....
103 days	.0125	.0186	.0015	.0268	....
In water:					
2 days	.0032	.0033	.0001	....	.0041
120 days	.0097	.0149	.0007	.0231	.0046
LOWLAND SOILS.					
In $\frac{1}{10}$ per cent citric acid:					
12 days	.0175	.0203	.0007	....	....
33 days	.0400	.0291	.0010	....	....
78 days	.0221	.0306	.0015	.0527	....
103 days	.0234	.0207	.0018	.0288	.0067

Solubility of constituents of upland and lowland soils in water and in citric acid of different strengths—Continued.

	Calcium oxid.	Potassium oxid.	Phosphoric acid.	Ferric and aluminic oxids.	Silica.
LOWLAND SOILS—continued.					
In $\frac{1}{50}$ per cent citric acid:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
12 days	0.0110	0.0187	0.0005	....	....
33 days	.0216	.0326	.0012	....	....
78 days	.0191	.0245	.0011	0.0199	....
103 days	.0140	.0167	.0016	.0144	0.0043
In water:					
2 days	.0054	.0047	.0030	....	.0003
120 days	.0170	.0168	.0004	.0111	.0045

"The most apparent result of the continued action of the dilute acid is seen in the effect upon the phosphoric acid, and more notably upon the iron."

"[In another series of experiments] the volume of water that the soils could absorb was determined. That volume known, enough citric acid was dissolved in it to make it exactly a $\frac{1}{10}$ per cent solution, and the solution was applied to known weights of the upland and lowland soils, respectively, as follows: Three hundred and ninety grams of water-free soil was put into beakers of 500 cc. capacity. . . . One-half of the solvent was applied through tubes [reaching to the bottom of the beakers], by which means the solution went to the bottom of the soil and rose upward by capillarity, and the other half was applied at the top, somewhat later, which descended by gravity to meet the rising volume, thus securing the most even distribution throughout the soil. The weight of each beaker was taken at the time of the first application, when exactly the volume of solution was added to saturate the soils. Every fourth day the weights of the beakers were retaken, the volume of water that had been evaporated ascertained, and a volume equal to that lost by evaporation was added to each beaker, and in this added water enough acid was dissolved to [restore the original acidity of the solution]. This was done at intervals of 4 days and continued for 120 days." The solvents used in these experiments were $\frac{1}{10}$ and 1 per cent solutions of citric acid and $\frac{1}{10}$ per cent solution of asparagin.

Similar experiments, lasting 130 days, were made with a different soil in galvanized iron pots holding 25 lbs. of soil. The results obtained in the latter experiments are summarized in the following table:

Solubility of soil constituents in water and in citric acid of different strengths.

	Calcium oxid.	Potassium oxid.	Phosphoric acid.
Soluble in water:	*Per cent.*	*Per cent.*	*Per cent.*
Natural soil	0.0038	0.0019	0.0011
After treatment with $\frac{1}{50}$ per cent citric acid	.0041	.0038	.0013
After treatment with $\frac{1}{10}$ per cent citric acid	.0045	.0046	.0010
After treatment with 1 per cent citric acid	.0092	.0077	.0006
Soluble in 1 per cent citric acid:			
Natural soil	.3410	.0380	.1270
After treatment with $\frac{1}{50}$ per cent acid	.4342	.0571	.1498
After treatment with $\frac{1}{10}$ per cent acid	.4544	.0582	.1408
After treatment with 1 per cent acid	.5056	.0543	.1482

"Little change was wrought by the action of the solvents in the amounts of lime and potash soluble in water. . . . We see, however, that the amounts of lime and potash rendered soluble in 1 per cent citric acid are enormous, even in comparison with the large proportions soluble in that solvent in the natural soil. There are features in the behavior of the potash which attract special attention. It is seen that less potash is found soluble in 1 per cent citric acid after the action for 130 days of the 1 per cent solvent than where the $\frac{1}{10}$ per cent solvent was used. This behavior is also repeated in the beaker series of experiments with the lowland soil. Also the phosphoric acid gives peculiar results of the same nature. In every example the soils acted upon for 130 days by the stronger solvents showed less phosphoric acid soluble in 1 per cent citric acid after than before the action. These peculiar results are bound up with the question of resorption."

To further study the question of resorption the following experiments were made:

"As a first test a given volume of a solution, which had been obtained by treating a soil with a dilute solution of citric acid, containing known amounts of given elements, was passed through a new quantity of the same soil. A second test consisted in passing another but a similar solution, which had been obtained by the action of a dilute citric acid solution upon the soil, through a totally different soil. . . .

"In the first test the result of passing the solution through the same soil was to increase its lime, to double its potash, and to reduce its phosphoric acid content. . . . In the second test, despite the very high potash content of the second soil, that soil took one-half of the potash out of the solution on its passing through; also the same soil, although its content of phosphoric acid was only one-fourth as large as that of the first soil, did not absorb any phosphoric acid from the passing solution."

Similar experiments on mixed soil are reported which show—

"(1) That the result of continuing to pass the solution through the soil from which it had been obtained was merely to dissolve out more of the several elements, excepting phosphoric acid.

"(2) [When the extract was neutralized with sodium carbonate before being passed through the fresh soil there was] an emphatic absorption by the fresh soil of all elements, notably of the lime, silicic acid, and iron. This is in particular agreement with observations upon the action of dilute citric acid upon neutral soils in distinction from the action of the same solvent on acid soils.

"(3) In the absence of the carbonic acid, furnished by the carbonate of soda, the lime and also the potash continue to increase in the solution when it is passed through the fresh soil. But almost one-half of the silica and phosphoric acid are taken out of the solution by the fresh soil with a notable amount of iron and alumina bases."

The average composition of the water of discharge of the Hawaiian Islands is given, and the losses from soils in drainage are discussed, it being claimed that it is erroneous to assume that "the composition of sea water represents the relative amounts of elements removed from the land and carried into the ocean by water."

A study was made in this connection of the relative proportion of soil constituents soluble in 1 per cent solutions of different acids. The results are given in the following table:

Elements dissolved by the action of one per cent solutions of different acids in twenty-four hours.

Acids.	Calcium oxid.	Potassium oxid.	Phosphoric acid.	Ferric and aluminic oxids.	Silica.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Aspartic	0.1065	0.0489	0.0054	0.0450	0.1060
Asparagin	.0078	.0117	.0015	.0050	.1740
Citric	.1110	.0260	.0037	.6630	.1990
Acetic	.1000	.0240	.0003	.0060	.0740
Tartaric	.1180	.0240	.0054	.1880	.1970
Oxalic	.0170	.0226	.0106	.5430	.2330

A comparison of amounts of soil constituents soluble in dilute acids with those removed by crops and in drainage water "shows that the elements lime, potash, and phosphoric acid that are being lost to the land have been and are being removed by the waters of discharge and by cropping in the same relative proportions. . . . Aspartic acid acts upon and dissolves the constituent elements of the soil in almost the exact relative proportions that those elements are removed by cropping and the waters of discharge. . . .

"Analyses of the upland soils show that under the action of 20 years' cropping and cultivation, and during the time of the production of 10 crops of cane, 40.2 per cent of lime, 16.6 per cent of potash, and 2.02 per cent of phosphoric acid have been actually removed from the land. As a result of the action of a 1 per cent solution of aspartic acid upon the upland soils for a period of 24 hours there were removed 40.2 per cent of lime, 18.1 per cent of potash, and 2.02 per cent of phosphoric acid; which amounts of material are almost exactly equal to the amounts of the same materials removed from the same soils by 20 years of cropping and during the production of 10 crops of cane."

On the presence of sulphurous acid in the air of the Tharand forests, H. WISLICENUS (*Tharand. Forst. Jahrb., 48 (1898), pp. 173–184*).

Tobacco soils, M. WHITNEY (*U. S. Dept. Agr., Farmers' Bul. 83, pp. 23, fig. 1*).—This bulletin discusses in a popular way "part of some preliminary work[1] which has been done in the examination of the soils of the principal tobacco districts of the country." The topics treated are climate and distribution of tobacco; soils of the several districts, including northern cigar-tobacco soils (Connecticut Valley, Pennsylvania, Ohio, and Wisconsin); southern tobacco soils (western Florida and the Florida peninsula); bright-tobacco lands; manufacturing-tobacco lands on the Atlantic; white-burley lands of Kentucky and Ohio; export-tobacco lands of Kentucky and Tennessee; the water content of northern cigar-tobacco soils, Florida tobacco soils, soils of the manufacturing and export tobacco districts; and control of the water supply of the soil.

Report on the composition of the soils of Carmargue, G. CASTINE (*Bul. [Min. Agr. France], 16 (1897), No. 4, pp. 614–665; 5, pp. 798–838; Ann. Sci. Agron., 1898, I, No. 2, pp. 240–320; 3, pp. 321–370*).—This is an exhaustive study of the soils along the Rhone in this region, special attention being given to an investigation of the nature of the alkaline soils (including a note by E. W. Hilgard on the analysis of the efflorescences of alkali soils).

On the reduction of nitrates in arable soil, P. P. DEHÉRAIN (*Ann. Agron., 24 (1898), No. 3, pp. 130–134*).—Experiments are reported in which the influence of different amounts of starch (1 and 2 per cent) and straw (1 per cent) on nitrification was determined in 2 soils. The nitrates uniformly decreased in the soil to which starch was added. With straw, however, the nitrates first decreased slightly and then gradually increased. The bearing of these results on the work of Wagner

[1] See also U. S. Dept. Agr., Division of Soils Bul. 11 (E. S. R., 9, p. 1035).

and Schneidewind (E. S. R., 8, pp. 761, 873; 9, p. 738) is discussed. It is claimed that the denitrifying action of manure and litter in the soil is insignificant unless these materials are applied in excessive amounts.

Soil bacteria with special reference to soil inoculation, R. S. MacDougall (*Trans. Bot. Soc. Edinburg, 1898, pp. 25–40*).

Some features of bacterial life in the soil, C. Lovén (*Landtmannen, 9 (1898), No. 24, pp. 380–383; 25, pp. 397–401*).

FERTILIZERS.

The home-mixing of fertilizers, C. E. Thorne (*Ohio Sta. Bul. 93, pp. 269–289*).—This bulletin discusses, in a popular manner, the following topics: The chemistry of fertilizers; carriers of nitrogen, phosphoric acid, and potash; the manufacture of fertilizers—the object of acidulation, the acidulation of tankage; the fertilizer trade; does home-mixing save only the cost of mixing; some objections to home-mixing; and the valuation of fertilizers. An account is also given of an experiment in which a comparison was made "of a few standard brands of factory-mixed fertilizers with home mixtures, made from tankage, acid phosphate, and muriate of potash, in such manner as to duplicate, as nearly as possible, the percentage composition in ammonia, available and total phosphoric acid, and potash claimed for the proprietary brands."

"The experiment was located at the northeastern substation, the soil of which is the heavy, white clay of that region. . . . A tract of apparently uniform land was selected and divided into three sections of 20 plats each, . . . the plats containing one-twentieth acre each, and a rotation was planned to include the three crops—corn, wheat, and clover, to follow each other in a 3-year course. To start the rotation [the first and second], sections were planted in corn and [the third] section was sown in soja beans, in order to have a leguminous crop preceding the corn crop of the second year. [The first and second] sections were both fertilized according to plan, thus giving a duplicate test the first year. This proved to be the more important, as [the first] section was found to be in much poorer condition than [the second] section, the latter section having grown clover the previous season."

While the season was unfavorable to the growth of corn, the results obtained "show as conclusively as a single season's work can show that there is no superiority in the factory-mixed fertilizer over the home mixture of equivalent composition, while the cost of the fertilizer is largely reduced by home mixing."

Bone superphosphate, F. Poquillon (*Monit. Sci., 12 (1898), pp. 408, 409; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 7, pp. 679, 680*).—It is shown that the determination of nitrogen can not be relied upon to distinguish between bone superphosphate and mineral superphosphate in cases where the latter are combined with nitrogenous matter. The author found that when bones which had been treated with hot water, carbon bisulphid, or light petroleum were converted into superphosphate by treatment with acid an additional amount of fat was set free. In superphosphate made from bones treated with hot water the amount of fat was from 10 to 12 per cent and from bones treated with petroleum 6.5 per cent of the phosphoric acid. Fat determinations in the nitrogenous substances which are likely to be combined

with mineral superphosphate in mixed fertilizers showed that there was no practicable combination of them with the superphosphate which would give a product containing as high a percentage of fat as the bone superphosphate. The fat determination therefore offers a means of distinguishing between the two classes of superphosphates.

Permanency of effect of lupines as green manure, L. GRANDEAU (*Jour. Agr. Prat., 1898, II, No. 43, pp. 590, 591*).—The author's experiments confirm those of Schultz-Lupitz in showing that lupines exert an effect on crops for at least 2 years after turning under.

On green manuring, RUMPER (*Ueber Gründungung. Schöneberg-Berlin: Stahel, 1898, pp. 48*).

Contribution to the knowledge of the bacteria in barnyard manure which decompose nitrates, KRENZ and M. GERLACH (*Jahresber. Landw. Vers. Stat. Jersitz-bei-Posen, 1897–98, pp. 13–20*).

Molasses as a fertilizer, P. BÔNAME (*Rap. Ann. Sta. Agron. [Mauritius], 1897, pp. 10, 11*).—The value of molasses as a fertilizer is briefly discussed and the results of 5 analyses are reported, from which the following table is calculated:

Fertilizing constituents per 100 gallons of molasses.

	Nitrogen.	Phosphoric acid.	Potash.
	Pounds.	*Pounds.*	*Pounds.*
Sample 1	4.75	1.33	27.00
Sample 2	7.00	.58	22.00
Sample 3	7.83	.66	22.25
Sample 4	6.16	.75	22.06
Sample 5	5.25	.75	19.30

Investigations on the action of sulphate of ammonia and nitrate of soda, G. KLOEPFER (*Untersuchungen über die Wirkung des schwefelsauren Ammoniaks und des Chilisalpeters. Essen: C. D. Baedeker, 1898, pp. 59, figs. 11*).—Numerous experiments by the author and by other investigators with different crops on a variety of soils are cited to show that sulphate of ammonia is as effective on certain classes of soils and on the majority of crops as nitrate of soda. Sulphate of ammonia gives best results on basic soils and should be used on soils deficient in bases only in connection with lime in some form—marl, burnt lime, or Thomas slag. The desirability of more completely collecting the sulphate of ammonia produced by coke ovens, with a view to cheapening this valuable domestic source of nitrogen, is strongly urged.

The production and consumption of Thomas slag and superphosphate in the world, MAIZIÈRES (*L'Engrais, 13 (1898), No. 43, pp. 1019, 1020*).—It is estimated that the production of superphosphate in 1897 was 4,000,000 tons, of slag 1,400,000 tons. The average consumption per hectare of slag in different countries is given as follows: Austria 2.41, Russia 3, Italy 7.85, France 12.80, Germany 29.57, England 40.25, and Belgium 101.87 kg.

Ground limestone in agriculture, N. HEILBRAN (*Das Kalksteinmehl im Dienste der Landwirtschaft. 1898, The Author; rev. in Ztschr. Fleisch u. Milchhyg., 9 (1898), No. 2, p. 37*).

FIELD CROPS.

Field experiments at the experiment farm at Lauchstädt in 1895 and 1896, M. MAERCKER (*Landw. Jahrb., 27 (1898), No. 1–2, pp. 82–174*).—This work consisted of fertilizer experiments on meadows and with sugar beets, barley, and alfalfa; variety tests of different field

crops; a test of legumes as catch crops on loam soils; a comparison of different methods of harvesting alfalfa and clover; a test of growing sugar beets after alfalfa; and a study of the influence of different crops on the moisture content of the soil. The cultivation of the crops and meteorological conditions of the seasons are described in detail and the results given in tabular form.

Experiments with sugar beets (pp. 82–94).—The object of these experiments was to compare a number of varieties and ascertain whether a top-dressing of sodium nitrate would have an injurious effect on the sugar content of the beets and whether certain varieties were more sensitive to this treatment than others. The field on which the experiments were conducted contained 11.19 acres and was divided into 6 plats, which were fertilized as follows: Plat 1 received 35.68 lbs. soluble phosphoric acid and 356.84 lbs. nitrate of potash per acre at planting time (April 27); plat 2, 35.68 lbs. soluble phosphoric acid and 178.42 lbs. nitrate of potash per acre at planting time; plat 3 received no fertilizer; plat 4, 178.42 lbs. nitrate of potash per acre on June 29, but no phosphoric acid; plat 5 (a check plat) was fertilized the same as plat 1; and plat 6 received 35.68 lbs. soluble phosphoric acid and 133.81 lbs. nitrate of potash at planting time and the same amount of nitrate of potash as a top-dressing on June 25. Owing to abnormal conditions, the variety test was abandoned. The smallest amount of leaves produced by any variety was 8,653 lbs. per acre and the largest amount 12,266 lbs. There was no discernible relation between the yield of leaves and the yield of beets, but there seemed to be a connection, although not quite regular, between the amount of leaves and the sugar content of the beets. Some of the more important varieties, averaging 11,874 lbs. of leaves per acre, contained on an average 17.52 per cent of sugar in the beet, and two varieties yielding 9,867 lbs. of leaves per acre had an average sugar content of 16.84 per cent, while the varieties producing only 8,653 lbs. of leaves per acre contained only 14.8 per cent of sugar in the beet. The entire structure of the plant and the amount of chlorophyll and its condition are considered equally important with the leaf surface; and as the sugar content of the beet depends on the amount of carbon dioxid assimilated, other things being equal, the amount of leaf surface would influence the sugar content. The sugar content of the beets was very satisfactory, although the season was wet and there was but little sunshine. During the months of April to October, inclusive, the rainfall was 404.6 mm. (nearly 16 in.) and the amount of sunshine for the months of May to October, inclusive, aggregated only 696 hours and 43 minutes. The amount of sunshine during August and September was especially low, aggregating only 128 hours 3 minutes. The longest time the sun shone on any September day was 4 hours 10 minutes. The average temperature during April to October, inclusive, was 57.6° F.; the highest average temperature for any month, 68.74°, was reached in

June. The author believes the high sugar content obtained was due to the continuous and regular growth of the beets during the entire season, and that a regular distribution of temperature and rainfall is more conducive to the production of an extremely high sugar content than a larger amount of heat.

The results of the fertilizer experiment showed that the application of 35.68 lbs. soluble phosphoric acid per acre did not increase the yield of beets and had no effect on the sugar content. The results with nitrogenous fertilizers were as follows: No nitrogen, 15.625 tons of beets per acre with a sugar content of 17 per cent; 178.42 lbs. potassium nitrate, 18.221 tons per acre with a sugar content of 17.1 per cent; and 356.84 lbs. potassium nitrate, 19.318 tons per acre with a sugar content of 16.63 per cent. The results did not show that the top-dressing had any influence on the sugar content of the beets.

Fertilizer experiments and variety tests with barley (pp. 94–119).—The field contained 11.18 acres. A test was made of 2 varieties of Hanna barley (Original and Benkendorfer) and 4 varieties of Chevalier (Trotha Saale, Heine Improved Chevalier, Heine Golden Melon, and Richardson Chevalier). The Benkendorfer Hanna barley is the original Hanna grown at Benkendorf for a number of years. The original Hanna produced the largest yield of grain, 64.52 bu., being 4.44 bu. per acre more than the average yield of the Chevalier varieties; while the Benkendorfer Hanna yielded only 1.02 bu. per acre more. The Chevalier varieties were about equally productive. The average yield of straw of the Chevalier varieties was 4,044 lbs. per acre and of the Hanna varieties 3,637 lbs. Taking the yield of grain and straw into consideration, the author believes Heine Improved Chevalier barley one of the best standard varieties. It is thought the Hanna varieties, like most varieties producing small amounts of straw, possess the advantage of requiring smaller amounts of moisture and plant food, and will be adapted to soils on which the profitable culture of the heavier straw-producing varieties is doubtful. These varieties are also 5 or 6 days earlier in maturing than the Chevalier. The following table shows some points of comparison between the two kinds of barley:

Comparison of the crops of Hanna and Chevalier varieties of barley.

	Protein content.	Weight of 1,000 kernels.	Weight per bushel.	Mealy grains.
	Per cent.	*Grams.*	*Pounds.*	*Per cent.*
Hanna barley (average of 2 varieties)	7.71	44.0	49.299	59
Chevalier barley (average of 4 varieties)	8.01	42.2	49.010	52

The fertilizer tests were made with applications of 535.26 lbs. kainit, 89.21 and 178.42 lbs. nitrate of soda, and 26.76 lbs. nitrogen in the form of crude Peruvian guano per acre. The object was to observe the effect of potash and nitrogen. On some plats the nitrogenous fertilizers

were applied in conjunction with kainit while in others no potash fertilizer was used. The soil contained approximately 0.25 per cent of potash. Some of the results obtained are as follows:

Average increase in yield of grain per acre of fertilized over unfertilized plats of barley.

	Pounds.
Kainit, 535.26 lbs. per acre:	
Hanna, average of 2 varieties	53.52
Chevalier, average of 4 varieties	405.90
Kainit, 535.26 lbs., sodium nitrate, 89.21 lbs. per acre:	
Hanna, average of 2 varieties	401.44
Chevalier, average of 4 varieties	142.73
Kainit, 535.26 lbs., sodium nitrate 178.42 lbs. per acre:	
Hanna, average of 2 varieties	292.60
Chevalier, average of 4 varieties	33.00

It is shown by these and other experiments that kainit, when applied with nitrogenous materials, not only increased the yield, but also improved the grain, the starch content and weight of the grain, and increased the percentage of mealy grains. Both applications of sodium nitrate were found profitable. The protein content was not increased and the quality of the grain was not impaired.

Results obtained from applications of nitrate of soda.

Fertilizer per acre.	Yield per acre.		Increase per acre over unfertilized plats.		Protein content.	
	Grain.	Straw.	Grain.	Straw.	Without kainit.	With 535.26 lbs. kainit per acre.
	Bushels.	*Pounds.*	*Bushels.*	*Pounds.*	*Per cent.*	*Per cent.*
No nitrogen	49.28	3,025.73			8.42	7.41
Sodium nitrate, 89.21 lbs	59.93	3,914.53	10.67	888.79	8.45	8.10
Sodium nitrate, 178.42 lbs	64.16	4,358.17	14.97	1,332.44	8.04	7.83

The plats fertilized with Peruvian guano yielded on an average 44 lbs. of grain and 308 lbs. of straw less than the plats which received the nitrate of soda, but the grain from the guano plats was heavier and contained less protein, more starch, a larger percentage of mealy grains, and better kernels. Each application furnished 26.76 lbs. of nitrogen per acre. Potash applied in conjunction with guano had no influence either on the yield or quality of the grain.

Variety tests (pp. 119-150).—Comparative tests were made with varieties of wheat, rye, oats, barley, peas, fodder beets, and potatoes. The preparation of the soil is described and the results obtained are given in tables.

Sixteen varieties of winter wheat, including 8 square head and 2 bearded varieties, were tested. One of the varieties classed with the square head sorts, a cross between a square head variety and an early maturing American variety, and known as Rimpau Bastard wheat, produced the largest yield of grain and was, with Mold Red Prolific, the earliest maturing variety in the experiment. The periods

of growth of the different varieties varied from 294 to 316 days. The square head variety grown in the vicinity of the experiment farm for a number of years yielded 8.89 bu. of grain and 996 lbs. of straw per acre less than the recently improved varieties of square-head wheat. The protein content of the square-head varieties was found to be quite low, being 9.21 per cent in the grain, 1.22 per cent in the straw, and 2.47 per cent in the chaff. The total amount of the protein obtained from equal areas was smallest in the square-head varieties. The author states that modern breeding has not yet produced a variety of square-head wheat which produces large yields and also has a high gluton content.

Of winter rye 7 varieties were grown. The best yielding varieties were Heine Improved Zeelander and Petkuser, yielding 52.09 and 51.61 bu. per acre, respectively. The Zeelander variety ripened in 282 and the Petkuser in 277 days. The average number of haulms per plant varied from 5.7 to 6.8 among the different varieties, being 6.3 for Heine Improved Zeelander, 6.4 for Petkuser, and 6.8 for the Göttinger variety. The Heine Zeelander and Petkuser varieties contained 8.75 and 8.22 per cent of crude protein, respectively. The author states that modern improvement of varieties seems to increase the yield by increasing the size of the grain and consequently the starch content, and that, as a result, the new varieties are poor in protein.

A comparative test was made of 7 varieties of spring wheat grown after sugar beets and alfalfa. The plats were fertilized at the rate of 26.76 lbs. of soluble phosphoric acid and 178.42 lbs. potassium nitrate per acre. The wheat was sown in drills March 27 at the rate of 2.02 bu. per acre. The yields are given in the following table:

Comparative yields of varieties of spring wheat.

Varieties.	Grown after sugar beets.				Grown after alfalfa.			
	Growing period.	Yield per acre. Grain.	Yield per acre. Straw.	Ratio of grain to straw.	Growing period	Yield per acre. Grain.	Yield per acre. Straw.	Ratio of grain to straw.
	Days.	*Bus.*	*Lbs.*		*Days.*	*Bus.*	*Lbs.*	
Bordeaux	141	41.39	3,969.8	1:1.60	141	47.07	4,506.8	1:1.60
Nöe	138	40.64	4,126.8	1:1.69	137	47.42	4,952.9	1:1.74
Heine verb. Kolben	137	37.61	4,167.8	1:1.85	137	46.06	4,981.4	1:1.80
Strube schles. Grannen	138	37.22	4,223.2	1:1.90	141	44.45	4,704.9	1:1.76
Siegesweizen	141	33.68	3,571.9	1:1.77	142	38.03	4,182.1	1:1.83
Grossrosenburger	141	36.84	5,120.6	1:2.32	138	45.76	5,084.9	1:1.85
Mammut	143	34.07	3,209.7	1:1.57	142	33.92	2,781.5	1:1.36

The wheat grown after alfalfa gave the best yields, but the grain did not fill as well as that grown after sugar beets.

A four-rowed variety of summer barley, grown on land which was in sugar beets the year previous, yielded 53.84 bu. of grain and 3,761 lbs. of straw per acre, but the grain produced was of poor quality.

Six varieties of field beets, a yellow and red sort each of the Oberndorfer, Eckendorfer, and Leutewitzer varieties, were grown after

alfalfa. The plants were fertilized with 356.84 lbs. of nitrate of soda per acre, and some plats received phosphoric acid at the rate of 53.52 lbs. per acre in addition. One-half of the nitrate of soda was applied as a top-dressing. The results showed that the application of phosphoric acid increased the protein content of the beets, and that the red sorts gave greater yields than the yellow. The data for the different varieties are given in the following table:

Composition and yield per acre of different varieties of sugar beets.

Varieties.	Yield per acre.		Composition of the beets.			Food material per acre in the beets.		
	Beets.	Leaves.	Dry matter.	Crude protein.	Nitrogen-free extract.	Dry matter.	Crude protein.	Nitrogen-free extract.
	Tons.	*Tons.*	*Per ct.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*
Red Eckendorfer	44.167	2.337	10.54	0.89	8.80	9,310.8	785.9	7,773.7
Yellow Eckendorfer	38.792	3.192	10.83	.98	8.99	8,112.7	734.1	6,975.3
Red Leutewitzer	35.685	5.275	14.38	1.05	12.40	10,263.6	749.3	8,849.6
Yellow Leutewitzer	34.589	5.319	14.45	1.06	12.47	10,012.0	734.1	8,626.6
Red Oberndorfer	35.007	4.926	13.08	1.12	11.43	9,158.2	784.1	8,003.0
Yellow Oberndorfer	34.245	4.003	13.08	1.12	11.43	8,958.0	767.2	7,828.1

Two early and 7 late varieties of oats were tested, and the results are discussed and tabulated. The plats received 89.21 lbs. potassium nitrate per acre, one-fifth being applied as a top-dressing. The results obtained are given in the following table:

Results of variety tests with oats.

Varieties.	Growing period.	Yield per acre.	
		Grain.	Straw.
	Days.	*Bushels.*	*Pounds.*
Early varieties:			
Milton	123	102.18	4,580
Duppauer	120	93.84	3,791
Late varieties:			
Trauben	123	104.09	4,510
Heine ertragreichster	126	101.93	4,228
Strube Schlanstedter	127	115.25	4,755
Beseler	127	106.09	5,254
Anderbecker von Rimpau	127	107.06	4,782
Bestehorn Überfluss	129	101.03	4,307
Leutewitzer Gelbhafer	129	110.56	4,387

In protein content the varieties differed immaterially, but Leutewitzer Yellow contained 5.12 per cent of fat, being nearly 1 per cent more than found in any other variety.

Among 16 varieties of potatoes, Professor Maercker produced the largest yield of tubers and starch, being 458.4 bu. of tubers and 5,225.9 lbs. of starch per acre. Next in order of productiveness was the variety Geheimrat Thiel with a yield of 427.8 bu. of tubers and 4,877 lbs. of starch per acre.

Growing sugar beets after alfalfa (p. 151).—Sugar beets on plats which had grown alfalfa the year previous were not only less productive, but

also lower in sugar content than beets grown on plats used for sugar beets the year before.

Fertilizer experiments on meadows (pp. 151–155).—A swampy meadow was drained and divided into 5 plats, 1 of which was left unfertilized, while 2 were fertilized with kainit and 2 with kainit and ground Thomas slag. No effect of the application was noticeable during the first year. It was found that on the plat which had received potash and phosphoric acid there was a greater admixture of leguminous plants, and consequently the protein content of the hay was increased.

A fertilizer experiment with alfalfa (pp. 155–157).—A field on which alfalfa had been grown for four years in succession was divided into three equal plats. One plat was left unfertilized, one received an application of 535 lbs. per acre of ground Thomas slag, and the other an application of 892 lbs. per acre of kainit and 535 lbs. of ground Thomas slag. The results do not show that the fertilization was very effective, but the following year the effect of the fertilizers was shown in the growing crop, the results of which will be reported later.

Experiments with legumes as catch crops on clay soils (pp. 157–163).—A barley field, after the crop had been removed, was divided into plats and sown with 6 different mixtures of legumes. The seed on some of the plats was inoculated with Nitragin.

The mixtures of beans, peas, and vetch and beans, and sand vetch and vetch made a good growth. The mixtures containing lupines made a less satisfactory growth, and the mixture of lupines, Victoria peas, and Lathyrus made a very poor growth. On the Nitragin plats many well-developed plants of lupine with normal nodule formations on the roots were found, but on the uninoculated plats normal plants of lupines with well-developed nodules were very few. The largest amount of nitrogen gathered per acre was by the mixture of beans, Victoria peas, and vetch, 137.76 lbs., which is equal to the amount contained in 892 lbs. of nitrate of soda, and the amount of organic matter produced equaled the amount furnished in 25.35 tons of stable manure. The results in 5 cases are but slightly in favor of inoculation with Nitragin, while in one case the inoculation produced no effect whatever. An oat crop grown after legumes made a remarkable growth, but the results have not yet been reported.

Methods of curing clover and alfalfa (pp. 163–170).—The report of this work has been abstracted from another source (E. S. R., 9, p. 439).

Influence of different crops on moisture content of the soil (pp. 170–174).—An experiment was conducted to ascertain the influence of different crops on the moisture content of the soil. The moisture content of fields of sugar beets, peas, winter wheat, potato, and oats was determined twice per week throughout the season from May 21. Sugar beets and potatoes lowered the moisture content comparatively little during the early part of the season, while with winter wheat and oats there was a much greater decrease in the percentage of moisture.

Throughout the experiment it was shown that the moisture requirement of peas was not as great as for the other crops. When the crops of peas and wheat had been removed the wheat-stubble field contained only 9.41 per cent of moisture to 14.9 per cent in the pea-stubble field. The moisture requirements for oats and alfalfa appeared to be greater than for potatoes.

Corn culture in the South, S. M. TRACY (*U. S. Dept. Agr., Farmers' Bul. 81, p. 21*).—The author discusses the soil and its preparation, crop rotations, fertilizers, varieties, the planting, cultivating, harvesting, and storing of the crop, and saving the seed. The results of experimental work with corn at various Southern experiment stations are given in connection with the discussion of the different operations and practices. In the discussion of varieties for the South it is advised that when corn is grown for ordinary purposes it should be a dent variety of local origin, ripening in from 150 to 170 days; the stalks should have well-developed roots, and average nearly two ears each of uniform diameter throughout, well filled at both ends and pointing downward when ripe; the cobs should be small in proportion to the size of the ear, and the individual grains should be long and so broad at the upper end as to leave only a slight depression between the rows.

"White varieties will usually make a heavier yield than colored varieties, though many colored varieties are more vigorous and hardy than some of the more prolific white varieties.

"It is as important to take seed from the best stalks as from the best ears, and whatever variety may be preferred, every ear which is selected for seed should be taken from a stalk which in size, habit of growth, and number of ears approaches closely to what is the desired form for that variety."

The cost of the production of corn and oats in Illinois in 1896 (*Illinois Sta. Bul. 50, pp. 53–76*).—The results presented in this bulletin were obtained from an investigation of the expense of raising the corn and oat crops of 1896 in Illinois. The estimate of the cost of production of these crops received from farmers throughout the State are tabulated.

Of 900 circulars distributed to obtain the necessary data 316 were returned with answers. Of these 274 and 170 were used in calculating the cost of producing the crops of corn and oats, respectively. The average yield of corn per acre on the farms taken into consideration was 54 bu. and of oats 34 bu. The yield of corn was somewhat above the average, while that of oats was considerably below the average yield. The cost of production as determined here "is the average sum of the expenditures on all the processes involved in production, from the preparation of the soil to the delivery at the elevator, including the wages of the farmer himself, whether owner or renter. A proper allowance is made for time lost and for maintenance of team during idleness, interest on investment, including rent and allowance for depreciation of tools and machinery." On this basis the calculated cost of production of corn was 19.5 cts. per bushel and $10.59 per acre, and the cost of production of oats 21 cts. per bushel and $7.76 per acre.

A report on flax culture for seed and fiber in Europe and America, C. R. DODGE (*U. S. Dept. Agr., Office of Fiber Investigations Rpt. No. 10, pp. 80, figs. 5, pls. 4*).—This report describes the different kinds of flax and the methods of flax growing practiced in Belgium, France, Poland, Ireland, and Russia, and reviews in general the work in the United States. The Loppens de Swarte system of retting and its advantages are pointed out. In considering flax culture in the United States, the author reviews the experiments made at the experiment stations and elsewhere and gives cultural directions, including selection and preparation of the soil, use of fertilizers, rotation of crops, sowing, harvesting, retting, and cleaning.

An experiment in flax culture made in 1895 in the vicinity of Puget Sound, Washington, is reported. The flax was grown from Riga seed, the 4 plats containing about 5 acres. The seed was sown too late and drought interfered with the growth of the crop, especially on sandy soil. Plat 1, containing $1\frac{1}{4}$ acres of sandy clay loam river bottom land, was sown at the rate of 2 bu. of imported Riga flax on May 18. No fertilizers were applied. The yield was at the rate of 3,865 lbs. of clean straw and 17 bu. of clean seed per acre. The conditions on plat 2 were identical with those on plat 1, but the flax was sown at the rate of $1\frac{1}{2}$ bu. per acre. The yield on this plat was at the rate of 3,557 lbs. of clean straw and 16.8 bu. of clean seed per acre.

In 1896 about 1 ton of flax straw grown in the Puget Sound region was sent to the Hilden Thread Works, Lisbon, Ireland, and there retted and scutched. The work was done under the direction of Mr. Frank Barbour, who reported the results in detail. In his report he says, "If the flax is grown and manipulated under proper conditions and by people who thoroughly understand the business in Puget Sound, we are convinced that the cultivation of it will be of greatest importance and in a short time would rival the great Belgium district of Courtraie."

Present status of flax culture in the United States, C. R. DODGE (*U. S. Dept. Agr. Yearbook 1897, pp. 471–486*).—This article contains a historical sketch of flax culture, a popular description of the more important species of flax, a discussion of European methods of culture, a comparison of the conditions of the industry in the United States and Europe, and suggestions for developing the industry of flax culture and manufacture in this country.

A report upon the grasses and forage plants and forage conditions of the Eastern Rocky Mountain region, T. A. WILLIAMS (*U. S. Dept. Agr., Division of Agrostology Bul. 12, pp. 78, figs. 30*).—This bulletin discusses the topographical features of the Eastern Rocky Mountain region, with a special consideration of the soil and the water supply. Detailed accounts of the cultivated grasses and forage plants and the more important plants native to the region are presented, the present prospect of the forage problem of the region is discussed, and methods for the improvement of ranges are suggested. An index to both common and botanical names is given.

The cultivated grasses most commonly found in the meadows and pastures of this region are timothy, redtop, Kentucky blue grass, smooth or Hungarian brome grass, meadow fescue, and orchard grass.

"The millets and the various small grains are quite generally grown for summer forage and for hay and grain, and the sorghums, both saccharine and non-saccharine varieties, are occasionally grown for fodder. Nearly all the common clovers are successfully grown in some part of the region, alfalfa and red clover being in most general cultivation. . . . Almost without exception they are irrigated, at least for a portion of the season. . . . There are about 270 species and varieties of grasses known to be indigenous to this region. . . . The most valuable species are quite widely distributed, although occasionally a species of but local occurrence may be of considerable importance in its particular locality, as is the case with some of those occurring in the mountains."

Besides the grasses a number of native clovers, vetches, lupines, rushes, sedges, sages, and other forage plants are discussed. The native meadow and hay grasses are considered under two groups: Those growing on low-land meadows and mountain meadows, and the native pasture grasses, as those growing on the plains and on the foothills and mountains.

Leguminous forage crops, J. G. SMITH (*U. S. Dept. Agr. Yearbook 1897, pp. 487–508, figs. 8, pl. 1*).—This article gives a short historical sketch of the cultivation of leguminous crops and discusses their value for feeding and fertilizing. Red clover, alfalfa, cowpeas, soja beans, crimson clover, Florida beggar weed, field peas, Dakota vetch (*Lotus americanus*), ground plum (*Astragalus crassicarpus*), Metcalfe bean, (*Phaseolus retusus*), and the Stolley vetch are considered at some length with reference to their culture and value.

Some Irish potato experiments, C. L. NEWMAN (*Arkansas Sta. Bul. 50, pp. 21–34*).—These experiments consisted of culture and variety tests of potatoes and the use of second-crop potatoes for seed.

For 3 years experiments were carried on with second-crop potatoes for seed and with northern-grown seed of the same varieties. The first year 2 varieties were grown, the second year 4, and the third year 7. The varieties planted for these trials were Beauty of Hebron, Bliss Triumph, Crown Jewel, Early Rose, Freeman, Puritan, Wood Earliest, and Peerless. Each set of plats contained the same number of plants. The results for each year are given in tables. The average results give northern seed the advantage in yield and earliness. The following table gives the average of each year's average for the entire series of experiments:

Second-crop seed compared with northern-grown seed—average of 3 years.

Character of seed.	Yield of merchantable potatoes.	Yield of culls per acre.	Total yield per acre.	Number of days from planting to maturity.
	Bushels.	*Bushels.*	*Bushels.*	
Northern-grown seed	94.91	11.19	106.10	108.54
Second-crop seed	81.29	16.04	97.34	111.67
Difference	13.62	4.85	8.76	3.13
Percentage difference	16.75	43.34	9.00	....

With but 2 exceptions the northern-grown seed proved to be superior. In 1896 Early Rose second-crop seed gave a better yield than northern seed, and Crown Jewel from second-crop seed ripened 3 days earlier than from northern seed. In general, second-crop seed was slow and irregular in starting and produced vines inferior in vigor and appearance. It was also found that potatoes from northern seed gave a better yield at different stages of growth than potatoes from second-crop seed. In 1896 the average yield of the 7 varieties from northern and second-crop seed on May 20 was 80.39 and 69.14 bu. per acre, respectively, and on June 1 89.35 and 82.75 bu. per acre.

Four plats were planted with large and small second-crop seed to compare the yields. Perfect whole tubers 2 to 3 in. in diameter were planted on plats 1 and 3, and whole tubers from $\frac{3}{4}$ to $1\frac{1}{4}$ in. in diameter on plats 2 and 4. Plats 3 and 4 were planted with cut tubers of the same size as those used on plats 1 and 2, respectively. Large whole potatoes yielded 18 per cent more than whole small seed, and the large cut tubers 15.8 per cent more than the small cut tubers.

The results of a series of culture tests were in favor of level as against ridge culture. The results are considered due largely to the drought and the sandy character of the soil. The rows were ridged 2, 4, 8, and 12 in. high and each increase in the height of the ridges resulted in a decrease in the yield.

Of 20 varieties tested, Ohio Jr., Crown Jewel, Early Six-Weeks Market, World's Fair, and Wood Earliest gave the best results.

An outlay of $2 per acre for spraying or dusting Paris green on the plants to destroy the potato beetles resulted in an increase of 11 bu. or 13.6 per cent per acre.

Sugar beets, H. SNYDER and A. BOSS (*Minnesota Sta. Bul. 56, pp. 377–416, figs. 4*).—This bulletin gives a summary of the sugar-beet investigations in Minnesota from 1888 to 1898, a report on the work for 1897, and an outline of the proposed experiments for 1898.

From 1888 to 1898, 1,351 samples of sugar beets from different parts of the State were analyzed. The average sugar content of these samples was 14.22 per cent, with 81.2 purity.

Average results of culture experiments with sugar beets, 1888 to 1897.

	1888.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.
Average sugar content (per cent)	13.4	12.9	14.1	15.0	15.2	17.2	15.6	13.7	15.0
Average purity coefficient	83.1	79.5	80.1	84.6	84.4	86.6	85.6	81.0	83.1
Highest sugar content (per cent)	20.3	17.9	20.4	19.1	18.4	19.4	20.6	18.2	18.3
Number of samples tested	111	55	465	185	15	14	22	25	303

The conditions which affect the sugar content of the crop are discussed at some length. In 1897 culture experiments were made at the station and by farmers throughout the State. The results are given in tables. The results obtained from sugar beets in different parts of the State under poor conditions of cultivation are reported separately.

Beets obtained in cooperative experiments carried on by 100 farmers in the vicinity of Albert Lea averaged 13.8 per cent of sugar, with a purity of 82. An experiment in seeding beets at different dates gave the following results:

Results of seeding beets at different dates.

Date seeded.	September 21.		October 28.		Average weight.
	Sugar in juice.	Purity.	Sugar in juice.	Purity.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Ounces.*
May 15	14.0	81.9	16.5	86.0	12.8
May 15	13.9	86.9	16.5	86.4	11.2
May 27	13.7	85.6	16.6	84.3	15.2
May 27	13.1	87.3	17.7	86.0	10.0
June 5	14.2	88.8	18.2	87.0	11.6
June 5	13.8	85.2	17.9	86.0	10.8

An experiment was made by the station to ascertain the best distance at which sugar beets should be grown. The following table gives the average results of two trials:

Results of sugar beets grown at different distances.

Distance.		Sugar content.	Coefficient of purity.	Yield per acre.	Value per acre.
In the row.	Between rows.				
	Inches.	*Per cent.*	*Per cent.*	*Tons.*	
4 inches	14	17.3	85.4	17.2	$68.80
6 inches	14	17.7	87.0	16.2	64.80
8 inches	14	16.1	85.7	16.9	67.60
10 inches	14	15.6	84.2	16.9	67.60
4 inches	18	18.0	89.8	16.2	64.80
6 inches	18	16.8	86.8	16.6	66.40
8 inches	18	16.2	87.9	17.6	70.40
10 inches	18	16.0	84.0	17.1	68.40
4 inches	24	16.5	85.1	15.2	60.80
6 inches	24	15.7	88.6	16.3	65.20
8 inches	24	16.3	87.1	16.1	64.40
10 inches	24	16.8	87.1	15.9	63.60
4 inches	30	15.9	83.7	16.5	66.00
6 inches	30	16.0	86.9	16.3	65.20
8 inches	30	15.4	88.1	17.5	70.00
10 inches	30	14.9	80.7	15.7	62.80

There was practically no difference in the average results from the rows which were 14 and 18 in. apart, and these distances gave the best returns. There was little difference in the average results from plats on which the beets were grown 2, 4, 6, and 8 in. apart in the row. "Economy of labor would dictate that for our conditions we plant the rows 18 in. apart and thin the beets to 5 to 7 in. apart in the row."

Sugar-beet investigations of 1897, G. W. SHAW (*Oregon Sta. Bul. 53, pp. 36, figs 14, dgms. 3*).—Cooperative culture experiments with sugar beets in 1897 were limited to the counties of the State which seemed best adapted to the production of sugar beets and the manufacture of sugar. The results of analyses of beets from each county are given in tables and the climatic conditions of the season are compared with the normal conditions of the region and those of France and Ger-

many. The culture of the sugar beet and the conditions for manufacturing are discussed at some length.

The average results for the different counties where experiments were conducted on a considerable scale are given in the following table:

Average results of sugar-beet experiments in 4 counties in Oregon in 1897.

Counties.	Sugar in juice.	Purity.	Yield per acre.	Cost per acre.
	Per cent.	*Per cent.*	*Tons.*	
Union	18.5	88.5	23.7	$11.20
Jackson	15.5	81.0	15.8	....
Washington	16.1	86.7	15.7	24.00
Clackamas	13.7	83.4	17.8	26.00

The average for the entire State (216 analyses) was found to be 15.24 per cent sugar in the juice, with a purity of 84.36 and an average yield of 18.54 tons per acre.

Irrigation experiments in sugar-beet culture in the Yakima Valley, E. FULMER (*Washington Sta. Bul. 31, pp. 30, fig. 1, pl. 1, map 1*).—In this bulletin the work with sugar beets at the station is reviewed and sugar-beet culture with irrigation discussed. The results of cooperative irrigation experiments with sugar beets are given in tables. A geographical and geological description of the Yakima Valley and the amount of land there reclaimed by means of artesian wells are given. Chemical analyses of soils from irrigated districts are summarized.

The averages of 68 samples from the irrigation experiments with sugar-beet culture were as follows: Sugar in the juice, 17.6 per cent; sugar in the beet, 16.7 per cent; purity, 85.2 per cent. The varieties grown were Kleinwanzlebener and Vilmorin.

Cultivation of tobacco in Sumatra, E. MULDER (*U. S. Dept. Agr., Cultivation of Tobacco in Sumatra, pp. 39, figs. 3, map 1*).—This publication is a paper on the method of cultivation of the tobacco crop of Sumatra and the physical features of the district in which the tobacco is grown. Statistics on the production and trade of Sumatra tobacco are given. The mean temperature and rainfall for each month for a number of years at Penang and Singapore and the results of mechanical analyses of Sumatra tobacco soils are given in tables. The physical features of the island, the introduction of tobacco, and the laying out and management of tobacco estates, with directions for building drying sheds and other buildings are discussed, and descriptive notes on the prevailing diseases of tobacco and the various operations in planting, cultivating, curing, and preparing the crop for market are given. The cost of growing tobacco in Sumatra is considered. The author states that a very good type of Sumatra tobacco is successfully grown in some parts of Florida, and that if special attention be given to the qualities which characterize Sumatra tobacco, namely, fine texture of the leaf and uniformity in color and length, there will be a large increase in the demand for the home-grown product.

Report of the agriculturist, W. H. BISHOP (*Delaware Sta. Rpt. 1897, pp. 211–213*).—A report is given of fertilizer experiments on rotation plats, with tabulated results. The applications of fertilizers consisted of 160 lbs. nitrate of soda, 400 lbs. acid phosphate, and 160 lbs. muriate of potash per acre. These different fertilizers were applied alone and in combinations of twos and threes, the application being made each year. On account of the poor condition of the soil, the application was doubled the first year of the experiment. Sweet corn, crimson clover, cowpeas, oats, and red clover, in the order given, have thus far entered into the rotation. The results from red-clover plats in 1897 indicated that muriate of potash is a suitable fertilizer for clover on that soil. The mixture of muriate of potash and acid phosphate was found a desirable fertilizer for cowpeas. The experiment is to be continued.

On the production of beet seed, J. F. LUNDBERG (*Landtm. Månadsbl., 1898, No. 9, pp. 129–131*).

Corn and its uses in America, G. ROSSATI (*Movimento Agricolo, 4 (1898), No. 44, p. 485*).

In the land of ginger—Jamaica, F. B. KILMER (*Amer. Jour. Pharm., 70 (1898), No. 2, pp. 65–85, figs. 6; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 4, p. 365*).—A popular article describing the methods of cultivating and preparing ginger for the market in Jamaica and giving statistics of the crop.

Fodder and forage plants (exclusive of grasses) (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 3, pp. 432–491, figs. 40*).—Illustrated descriptive notes are given of numerous fodder and forage plants, the bulk of the information being taken from Bulletin 2 of the Division of Agrostology, U. S. Department of Agriculture.

Cultivation of orris root in Italy (*Rpt. of Schimmel & Co., 1897, Oct., p. 38; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 1, p. 68*).—A description of methods of culture and preparation for the market.

West Australian saltbushes, F. TURNER (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 3, pp. 418–431, figs. 9*).—Notes are given on some of the native species of saltbushes and illustrated descriptions of the following: *Atriplex cinerea, A. halimoides, A. semibaccata, A. stipitata, A. vesicaria, Kochia planifolia, K. villosa, Rhagodia billardieri*, and *R. nutans*.

Saltbushes and their cultivation, A. MORRISON (*Producers' Gaz. and Settlers' Rec. [West. Australia], 5 (1898), No. 5, pp. 359, 360*).—Brief notes are given on the value of saltbushes and on methods for their propagation.

Notes on the selection of sugar cane, P. BÔNAME (*Rap. An. Sta. Agron. [Mauritius], 1897, pp. 49–55*).—Several experiments in selecting canes for propagating purposes are reported. In some cases canes high in sugar content produced canes richer in sugar than canes with low sugar content, while in one instance the reverse was the case. In several of the tests the progeny of the canes high and low in sugar content showed but little difference in quality. It was also shown by experiments that canes propagated from cuttings taken from the upper part of the stalk are not necessarily inferior. The canes grown from such cuttings had in some cases a higher and in others a lower sugar content than canes grown from cuttings taken from the body of the stalk. In all cases the yield was in favor of cuttings taken from the upper part of the stalk, owing, it is stated, to the fact that these cuttings make the best growth.

Composition and yield of different varieties of sugar cane, P. BÔNAME (*Rap. An. Sta. Agron. [Mauritius], 1897, pp. 24–44*).—The results of analyses of 61 varieties of sugar cane at different stages of growth and of a large number of seed canes are given in tables. The crop and weather conditions are briefly noted. Similar work has been previously noted (E. S. R., 9, p. 638).

Fertilizer experiments on sugar cane, P. Boname (*Rap. An. Sta. Agron.* [*Mauritius*], *1897, pp. 45–48*).—Experiments on commercial fertilizers applied singly and in combination were made on 20 plats and the results obtained are here reported in tables. Nitrogenous fertilizers, dried blood, ammonium sulphate, and sodium nitrate, were most effective when applied in combination. Potash in the form of chlorid gave a larger increase in yield than when applied in the form of nitrate or sulphate.

Experiments with Nitragin during the summer of 1897, J. E. Palmer (*Tidskr. Landtman, 19* (*1898*), *No. 10, pp. 175–179*).—Practical testimony, on the whole favorable.

Nitragin (*Pennsylvania Dept. Agr. Bul. 34, pp. 53–56*).—Brief popular notes are given concerning this preparation and quotations are given from the publications of several who have made experiments with the substance.

The culture of tobacco, O. C. Butterweck (*U. S. Dept. Agr., Farmers' Bul. 82, pp. 24*).—This bulletin gives complete directions for the culture of tobacco, discussing the following points: Selecting, saving, and sowing the seed; preparing the seed bed; and planting, cultivating, fertilizing, topping, and cutting the plants. A note on the destruction of insect pests injurious to tobacco is given.

Progress in tobacco culture, R. Kissling (*Chem. Ztg., 22* (*1898*), *No. 52, pp. 524, 525*).—A review of recent experiments on tobacco in different countries. The work is described in abstract form and comprises a study of a nematode disease of tobacco and fertilizer and culture experiments carried on to determine the effect upon the quality of the crop, especially its fire-holding capacity.

Wheat experiments, D. Beveridge (*Agr. Gaz. Tasmania, 6* (*1898*), *No. 1, p. 15*).—Results of a test of 14 varieties of wheat are given in a table. Smith Nonpareil and Blount Limbrigg were free from rust and The Blount and Square Head were most productive.

Winter and summer pasture in Mississippi, E. R. Lloyd (*Mississippi Bul. 50, pp. 12*).—This bulletin contains directions for the preparation of the soil for permanent pasture and notes on Bermuda grass, carpet grass, lespedeza, melilotus, hairy vetch, turf or winter oats, redtop, alsike clover, and pasture grasses. Grass mixtures suitable for pine-woods soils, yellow and brown loams, and prairie soils are suggested. The water supply of pastures is considered in a short note.

Plant culture in Denmark during 1897, K. Hansen (*Tidsskr. Landökon., 17* (*1898*), *No. 1–2, pp. 5–25*).

HORTICULTURE.

Horticulture: Results for 1896–97, W. C. Stubbs, F. H. Burnette, and E. Watson (*Louisiana Stas. Bul. 52, 2. ser., pp. 285–332*).—This bulletin contains remarks on the seasons of 1896 and 1897, and notes and tabulated data on the following crops grown at the stations during these two years:

Vegetables.—Chinese cabbage (*Pe Tsai*), asparagus, beans, beets, Brussels sprouts, cabbages, cauliflowers, carrots, celery, sweet corn, cress, cucumbers, cantaloupes, eggplant, endive, kohl-rabi, lettuce, leeks, watermelons, mustard, okra, onions, peas, parsley, peppers, Irish potatoes, sweet potatoes, pumpkins, radishes, spinach, tomatoes, squashes, and turnips. *Fruits.*—Apples, figs, pears, peaches, plums, Japan persimmons, grapes, cherries, almonds, apricots, nectarines, pomegranates, medlars, goumi, strawberries, raspberries, blackberries, dewberries, nuts, and citrus fruits.

In comparative tests of northern with home-grown seeds, the seeds grown upon the grounds of the stations gave equally good or better

results in the case of cucumbers, cantaloupes, lettuce, peppers, Irish potatoes, pumpkins, radishes, and tomatoes. The results in many of the other crops are not indicated. Tabulated data are given on fertilizer tests with cabbages, cantaloupes, eggplants, watermelons, Irish potatoes, sweet potatoes, and tomatoes, and an experiment in growing cucumbers under glass is described. The comparative ability of the crops to endure the drought is reported. Mention is made of the striped cucumber beetle (*Diabrotica vitata*) and the 12-spotted beetle (*Diabrotica 12-punctata*), and a mixture of 12 qt. of air-slaked lime and 1 pt. of coal oil applied with a hand bellows or powder gun is recommended for keeping them in check.

Winter forcing of asparagus in the open field, J. C. WHITTEN (*Missouri Sta. Bul. 43, pp. 54–62, figs. 2*).—Various methods of forcing asparagus are noted and a method of forcing a crop in the field is described. Forcing asparagus in the field has two advantages over removing the roots to a forcing house. It avoids the trouble and expense of transplanting them and it saves the plants from being ruined by the forcing process, as in the case of plants removed to forcing houses. The method used at the station is as follows: Trenches are made between the rows by running a double furrow, throwing the soil in the rows of plants, and then making the trenches uniform with a spade. When finished they are 3 or 4 in. lower than the crowns of the plants. They are then covered with 12-in. boards resting on 4-in. blocks on either side of the trenches, thus forming tunnels between the rows. The boards are covered with 2 or 3 in. of soil and then the whole bed is covered with 5 or 6 in. of horse manure. Steam is carried from the boiler to the central tunnel by a steam pipe and from there forced into the tunnels through steam hose. The steam penetrates the soil of the beds, warming it to the desired temperature.

This method was tested at the station in the winter of 1896. The field used had been planted to asparagus some 10 years previous to the experiment. Six rows 4 ft. apart and 50 ft. long were prepared for forcing. Steam was first applied November 14. It was discharged in each tunnel for not over 5 minutes at a time, about 1 hour being required to heat the bed to a temperature of 60° F. After the first day the bed was steamed on an average of twice in 3 days, and only for 5 minutes for each tunnel. The first asparagus was cut 10 days after steaming was begun. It was as large as that ordinarily produced in spring and much more crisp. Cuttings were made almost daily for a month, when the growth became weak. The second test was begun December 16 and carried out as in the first test. The bed prepared for forcing was 25 by 75 ft. The first cutting was made 2 weeks after the first steaming. The time of cutting was more irregular than in the first test, and was prolonged about 2 months. The weather being colder, somewhat more steam was required than in the first test. The plants forced were allowed to grow without cutting during the summer of 1897, and the spring growth of

1898 showed that one season's growth after forcing was sufficient for the plants to regain their normal vigor. In the winter of 1897–98 a test was made with a bed 25 ft. square, to determine the amount of coal necessary to force a given area of asparagus and the value of the product. The steam was first used December 29, the first asparagus was cut January 12, and cutting was continued until February 25. Steam was forced into the tunnels a total of 60¼ hours; 2,308 lbs. of coal, valued at $1.82, were used in heating the bed. The yield was 162 bunches (80 lbs.), valued at from 10 to 20 cts. per bunch.

It was found that about 5 minutes at a time was as long as steam could be forced into a tunnel without danger of overheating the asparagus. In regard to the advantage of allowing the steam to come in direct contact with the soil, the author says:

"The steam, coming in direct contact with the soil, readily penetrates it, heating the whole bed uniformly; whereas if the tunnels are heated by inclosed steam or hot-water pipes, the soil becomes too hot and dry close to the tunnels, while it is too cold midway between them. Forcing steam into the tunnels keeps the soil moist and maintains more continuous fermentation of the manure mulch, thus promoting steady heat."

The bulletin concludes with general remarks and suggestions on the culture of asparagus in Missouri.

Improvement of the wild carrot by grafting it on the cultivated carrot, L. DANIEL (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 2, pp. 133–135*).—The author reports the results of grafting the wild carrot upon a well-known variety of cultivated carrot having red roots. The stock exerted an influence not only upon the scion itself, but also upon the seedlings of the scion. The seedlings presented anomalies in the number and form of the cotyledons, the young plants from the grafted wild carrot were larger, greener, and less villous than those from the ungrafted wild carrot—i. e., in general intermediate between the wild and cultivated carrot. As the plants became older some of them followed the spreading habit of the wild carrot and others the erect habit of the cultivated carrot. The roots were white, like those of the wild carrot, but with a diameter from 2 to 3 times that of the latter and from one-fourth to one-third that of the cultivated carrot. Out of 30 plants from the grafted carrot 8 ran to seed the first season, an occurrence which, though fairly common in the cultivated carrot, is very rare in the wild carrot. The author believes that these results demonstrate the possibility of improving wild plants by grafting, followed by an intelligent selection of the offspring of the scion.

The fruit industry and substitution of domestic for foreign-grown fruits, W. A. TAYLOR (*U. S. Dept. Agr. Yearbook 1897, pp. 305–344, pls. 5*).—This article treats of the history of the development of the fruit industry in the United States and of the importation and exportation of fruits, and notes briefly the possibility of substitution of domestic for foreign-grown fruits. Numerous tables are given showing

the statistics of imports of fruits and fruit products by decades from 1830 to 1890 and by years from 1891 to 1897. Imports of many classes of fruits have decreased noticeably in the last few years, owing to the increased home production of these fruits and of others which have been substituted for them. Exports of such fruits as are exported, notably the apple, has steadily increased. Exports of canned and dried fruits of various kinds are becoming very important. In 1897 the total exports of fruits, fruit products, and nuts were valued at $7,828,572, as against similar imports to the value of $20,962,782.

A report on damage to fruit trees caused by the severe freeze of November 26–28, 1896, J. A. BALMER (*Washington Sta. Bul. 30, pp. 20*).—In a preliminary note the use of the nomenclature recommended and adopted by the American Pomological Society is urged. During the summer of 1897 the author visited the fruit-growing regions in the Wallawalla, Yakima, and Snake River valleys, and a large number of orchards in the Palouse country and in western Washington, and has reported in this bulletin the information gathered here concerning the damage done to fruit trees by the unusual cold period of the previous November. Several peculiar effects of the cold were brought out by the study. Of trees under apparently the same conditions one may have been severely affected while another of the same variety 25 ft. distant escaped uninjured. The trunks of some Agen prune trees were burst wide open, while others near by were left apparently in good order. Certain branches of a tree would be entirely killed while others were scarcely damaged. Detailed reports of 13 orchards in the Wallawalla Valley, 13 in the Yakima Valley, and 3 in the Palouse country including that of the station are given, also tables showing the percentage of dead and damaged trees in the Wallawalla and Yakima valleys. The conclusions reached are summarized in substance as follows:

"On low damp ground the damage to trees was very great, while trees of the same age and variety on drier grounds came through uninjured. Trees with high exposed trunks, especially those leaning from the afternoon sun or from the southwest, were greatly damaged in trunk, while in many cases the limbs and young growth were not affected. Agen prune is tenderer than Italian, Golden Drop, or Pond. Napoleon cherry is one of the tenderest varieties grown in the State. It suffered everywhere in the eastern part of the State, except possibly in the Snake River Valley. Of the popular varieties of apples, Yellow Newtown, Esopus, Yellow Bellflower, and Fall Pippin proved most tender. The hardier varieties are Ben Davis, Blue Pearmain, Jefferis, Fameuse, Twenty Ounce, Red June, Red Astrachan, Gloria Mundi, Missouri, Yellow Transparent, Limber Twig, and Waxen. Seedling peaches proved much hardier than budded trees. Amsden, Elberta, and Foster proved as hardy as any in their class. Alexander proved very tender. The damage was greatest where the land was lowest and where the cold air was held in pockets. In most instances late summer irrigation proved injurious, causing the trees to grow too late in the fall, leaving them in a very tender condition to go into winter quarters. Late cultivation has a similar effect on fruit trees as has late irrigation. It is not safe to cultivate much later than the middle of July. Where orchards were weedy and little cared for, the damage by frost was light; this, however, is no plea for weeds, but goes to show that if trees are encouraged to mature their wood early in the fall they will be

in better condition to endure the rigors of winter. While the author is firmly of the opinion that fall and winter irrigation is absolutely necessary, yet it seems to him to be a mistake to keep up irrigation or even cultivation during the weeks in the fall when trees naturally mature their wood; better to have a few weeds than to have a lot of immature wood and late growth. After the leaves are well down and growth has ceased is a good time to apply water; this is nature's way."

Lawns and lawn making, F. LAMSON-SCRIBNER (*U. S. Dept. Agr. Yearbook 1897, pp. 355–372, pls. 7*).—The article gives suggestions for the establishment and care of lawns, based upon replies to a circular of inquiry addressed to superintendents of parks in various parts of the United States and upon the experience of the author. A number of replies to the circular are quoted. In regard to the selection of lawn grasses the author says:

"The varieties suited to temperate climates, not subject to excessive drought or where water may be employed, are Kentucky blue grass, Rhode Island bent, and creeping bent. For shaded streets and parks, hard fescue and various leafed fescue, especially the latter, may be used to advantage, and in northern latitudes woodland meadow grass is a desirable variety for shaded situations. In the warmer portions of the South, Bermuda and the variety known as St. Lucie grass stand first, and when the soil is somewhat moist or very sandy St. Augustine grass may be substituted. Curly mesquite is recommended for trial in the warmer regions of the Southwest too dry for the successful cultivation of Bermuda."

The turf formed by various grasses is illustrated from photographs. Thorough preparation and constant care are considered essential to success with lawns. By way of summary the author says:

"A perfect lawn consists of the growth of a single variety of grass, with a smooth even surface, uniform color, and an elastic turf which has become, through constant care, so fine and so close in texture as to exclude weeds, which, appearing, should be at once removed. Briefly, such a lawn may be secured by thorough preparation of the soil and the application of suitable fertilizers; by seeding with pure seed of the highest quality; by proper attention to irrigation and the maintenance of fertility; by the prompt removal of weeds, and, finally, by the frequent and intelligent use of the roller and lawn mower."

Cultivation of the sweet potato, J. A. FRYE (*Jour. Jamaica Agr. Soc., 2 (1898), No. 11, pp. 475, 476*).—Popular notes.

Some edible and poisonous fungi, W. G. FARLOW (*U. S. Dept. Agr. Yearbook, 1897, pp. 453–470, pls. 10*).—The paper gives in a popular way the characteristics of a few of the most common edible and poisonous fungi. The forms considered are *Agaricus campestris, A. arvensis, Amanita phalloides, Hypholoma appendiculatum, Coprinus comatus, C. atramentarius, C. micaceous, Lepiota procera, Cantharellus cibarius, Marasmus oreades, Lactarius delicosus, Pleurotus ostreatus, Boletus subluteus, Fistulina hepatica, Hydnum imbricatum, H. repandum, Morchella esculenta, Lycoperdon giganteum, L. cyathiforme,* and *Scleroderma vulgare*. These are illustrated by plates. A number of rules are given to aid the collector in determining edible fungi.

Some edible and poisonous fungi, W. G. FARLOW (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 15, pp. 453–470, pls. 10*).—This is a reprint from the Yearbook of this Department for 1897 (see above).

Edible agarics, M. R. (*Jour. Hyg., 23 (1898), No. 1141, pp. 361–363*).—A general description of the cultivation of mushrooms in Paris, condensed from an article in *Science Française*.

Cherry culture, G. H. POWELL (*Delaware Sta. Rpt. 1897, pp. 175–197, figs. 9*).—A reprint of Bulletin 35 of the station (E. S. R., 9, p. 834).

Strawberries, F. S. EARLE (*Alabama College Sta. Bul. 94, pp. 139-154*).—A popular bulletin on growing and marketing strawberries. "In the opinion of the writer the strawberry acreage of the State could be largely increased with profit, and with less chance of loss than with most other horticultural crops." Directions are given for the selection of soils, use of fertilizers, preparation of soil, planting, cultivation, and mulching. Insects and diseases affecting strawberries are briefly considered, and notes are given on picking, packing, and shipping the fruit. From tests of 35 varieties grown for 2 seasons under rather unfavorable conditions, the author thinks the following can safely be recommended for general planting in all parts of Alabama: Michel, Lady Thompson, Brandywine, and Glenn Mary. Gardner and Meeks produced the most vigorous vines and hardiest foliage.

Pruning, O. E. ORPET (*Amer. Gard., 19 (1898), No. 193, p. 619*).—The gist of the article is given in the author's summary, as follows: "Summer pruning tends to direct the vigor of the trees into legitimate channels making spring pruning a very small matter when the former has been followed up from the time of planting the trees. Spring pruning is necessary when the trees have been neglected for a time. It will not check vigorous growth, rather increase it indeed, but in summer see that this vigor is so placed as to form good fruit bud bearing wood by summer pinching of the strongest growths. . . . All flowering shrubs should be pruned after flowering; then a good display is secured, and the efforts of the shrub are directed toward making wood to flower next season."

The fruit industry and substitution of domestic for foreign-grown fruits, W. A. TAYLOR (*U. S. Dept. Agr., Division of Pomology Bul. 7, pp. 305-362, pls. 5*).—This is a reprint from the Yearbook of this Department for 1897 (see p. 549), with the addition of a discussion of fruit exports and notes on 10 varieties of apples suitable for the export trade as follows: Baldwin, Ben Davis, Jonathan, Northern Spy, Rhode Island, Roxbury, Tompkins King, Winesap, Yellow Newton, and York Imperial.

The reciprocal action of scion and stock (*Gard. Chron., 3. ser., 24 (1898), No. 616, p. 288*).—A brief review of Daniel's work with carrots (see p. 549) is given, with a note on the physiology of the interaction of stock and scion.

The effect of stock on scion, and vice versa (*Wiener Illus. Gart. Ztg., 23 (1898), Nos. 8-9, pp. 299, 300*).—A brief review of Daniel's work (E. S. R., 5, p. 1089; 9, p. 945; 10, p. 549).

The effect of the graft on the flavor of the fruit (*Gard. Chron., 3. ser., 24 (1898), No. 614, p. 246*).—Notes on the work of Daniel and other authorities (see p. 549).

The principles and practice of bulb growing, W. C. WORSDELL (*Gard. Chron., 3. ser., 24 (1898), No. 624, p. 422*).—One of a series of articles on this subject.

Bulb growing in America, W. F. MASSEY (*Amer. Florist, 14 (1898), No. 544, p. 400*).—The successful growing of bulbs of Dutch and Roman hyacinths, narcissi, and *Lilium candicum* in North Carolina is reported. The author believes that with experience Bermuda lily bulbs can also be grown successfully.

Italian cannas in 1898, E. ANDRÉ (*Rev. Hort., 70 (1898), No. 21, pp. 497-500, fig. 1*).—Notes on new Italian cannas.

Cannas in 1898, J. S. WILSON (*Amer. Florist, 14 (1898), No. 551, pp. 625-628, fig. 1*).—Brief notes on a considerable number of varieties of cannas grown at Western Springs, Illinois, in 1898.

The cyclamen, W. W. GORDON (*Amer. Gard., 19 (1898), No. 203, pp. 773, 774, fig. 1*).—The article gives a method of culture by which cyclamens are carried over two years instead of being allowed a resting period at the end of one year's growth.

Economic use of bamboos, A. B. FREEMAN-METFORD (*Gard. Chron., 3. ser., 24 (1898), No. 605, p. 92*).—A brief synopsis is given of a lecture delivered by the author before the Royal Horticultural Society at its meeting July 19, 1898.

The shrubby St. John's worts, W. J. BEAN (*Garden, 54 (1898), No. 1413, pp. 490-492, figs. 3, pl. 1*).—Notes upon the adaptability of the genus Hypericum for garden planting, together with descriptive and cultural notes on certain species.

How to make a lawn, H. A. SURFACE (*Amer. Gard., 19 (1898), No. 205, pp. 805, 806*).—Directions are given for making and caring for lawns. To sow an acre the author recommends a mixture as follows: June grass 10 lbs., redtop 10 lbs., perennial rye grass 10 lbs., rough meadow grass 5 lbs., timothy 5 lbs., sweet vernal grass 5 lbs., and white clover 5 lbs.

Notes on watering, F. CRANEFIELD (*Amer. Florist, 14 (1898), No. 545, pp. 434, 435, fig. 1*).—The article gives a few notes on the use of warm and cold water for both greenhouse and outdoor plants, the notes being supplemental to those given in a previous issue (E. S. R., 9, p. 1053).

SEEDS—WEEDS.

Wind distribution of seeds, E. M. HUSSONG (*Proc. Nebraska Acad. Sci. 1896, pp. 253–257*).—Under the author's direction experiments were carried on for 4 years to ascertain the effect of wind as a distributing agent of weed seeds. In order to secure the data desired, deep tin cans were anchored in a number of different exposures in such a way as to collect seeds and other débris carried by the air. The collection made in September for 4 years is tabulated, which shows the following percentages:

Weed seeds distributed by winds.

Orders.	Per cent.	Orders.	Per cent.
Portulacaceæ	14.6	Cyperaceæ	4.2
Compositæ	12.7	Onagraceæ	4.1
Amarantaceæ	12.3	Cruciferæ	3.8
Chenopodiaceæ	9.8	Leguminosæ	3.7
Plantaginaceæ	7.5	Polygonaceæ	2.5
Asclepeidaceæ	7.2	Convolvulaceæ	1.5
Gramineæ	6.7	Unknown	4.1
Solanaceæ	4.5		

It appears that of these seeds 16.1 per cent were distributed by breezes, 17.8 per cent by local winds, 36.3 per cent by high winds, and 26.6 per cent by continued gales. Naturally the ones distributed by the lighter winds were those which were provided with pappus or some other special arrangement for distribution, while the heavier seeds are scattered only by the high and continuous winds.

In October 20 per cent more Compositæ, 8 per cent more of milkweeds, and from 1 to 3 per cent more grasses, amaranths, and chenopods were collected. In November the collections were notable for a very great increase in the percentages of amaranths and chenopods. During December, January, February, and March, on account of the ground being covered with snow or frozen, but slight movements of seeds were observed. In April the spring winds produced quite a marked effect on the distribution, and at this time seeds of the common purslane, tansy mustard, black mustard, wild pea, and winged dock were very abundant in their distribution.

These experiments only show data relative to the horizontal distribution of seeds, it being generally believed that the distribution of weed

seeds takes place within the stratum of air that lies about 30 or 40 ft. from the earth's surface. The desirability of investigations as to vertical distribution is pointed out.

An investigation of various germination media, B. JONSSON (*Report Lund Seed-Control Station for 1897, pp. 7-12, 28, 29*).—The general practice adopted in Scandinavian seed-control stations is to germinate the seed between pieces of moist paper or cloth. The medium in which the seed is placed differs greatly among the Swedish stations. The author collected over 30 different kinds of paper or cloth used for this purpose in Swedish stations, and subjected them to a critical examination. A number of samples were tested to study which kinds were especially adapted for the purpose in view, and determinations made of weight, ash content, porosity, hygroscopicity, and rapidity of evaporation from the surface of the paper or cloth. The samples examined were grouped as filter paper, blotting paper, brown paper, felt, moleskin, and linen. The following table shows the average data obtained for these groups of media:

Examination of germination media.

Medium.	Number of samples.	Weight of 19.76 sq. cm.	Ash content.	Height to which water rose, during 3 min.	Amount of moisture taken up in saturated atmosphere during 24 hours.	Evaporation during 4 hours—Per gram of medium.	Evaporation during 4 hours—Per same surface (19.76 sq. cm.).
		Grams.	*Per cent.*	*Mm.*	*Per cent.*	*Grams.*	*Per cent.*
Filter paper (white)	11	0.17	0.46	2.90	25.5	2.695	69.0
Blotting paper (white or colored)	12	.37	*a* .47	31.0	16.0	1.806	62.0
Brown paper	9	.25	2.06	13.0	24.0	1.777	58.5
Felt	2	.70	....	3.5	19.5	.483	9.0
Moleskin	1	1.02	.10	68.0	11.9	.315	11.0
Linen	1	....	....	21.0	....	....	62.5

a Average for 6 samples.

In order to be adapted for use in germination tests, the paper should be pure, free from injurious components or coloring matter, and as far as possible free from fungi and bacteria. It should therefore be kept and handled carefully, and preferably sterilized. It should be soft and pliable and of good keeping quality. Its ash content should be as low as possible, since a high ash makes the paper hard, and may interfere with the germination by the ash components being dissolved in the water of the germination bed. Porosity is essential, to permit of circulation of air; for this reason heavily sized paper is objectionable. In the author's opinion a paper fulfilling the preceding demands is preferable to either clay or terra-cotta dishes, sand, or soil beds.—F. W. WOLL.

Report of Swedish seed-control stations for 1896 (*Meddel. K. Landtbr. Styr., 1897, No. 42, pp. 314-382*).—The report includes the average data, with extremes, of 9,913 seed analyses made at the 18 Swedish

State seed-control stations, of which 3,588 analyses were made for farmers, 5,548 for seedsmen, and 777 in investigational work conducted by the stations. Of the analyses made, 25.1 per cent were made at the Lund Station, 12.9 per cent at Stockholm Station, 11.7 per cent at Oerebro Station, and the rest divided among the remaining 15 seed-control stations.

While the quality of most kinds of seed examined was very good, considerable variations were found, as shown below:

Variations in percentage of pure viable seed.

Kind of seed.	Number of samples.	Pure viable seed. Average.	Maximum.	Minimum.
		Per cent.	*Per cent.*	*Per cent.*
Winter rye	308	90.1	99.7	18.8
Two-rowed barley	296	95.8	99.9	14.7
Six-rowed barley	200	96.1	100	13
White oats	414	91.7	100	8
Red clover	1,296	88.1	98.7	1.4
Kidney vetch	29	87.5	98.8	5.8
Timothy	615	86.1	99.2	36.2
Swedish turnip	100	95.5	99.9	27.5
Carrot	59	60.9	92.5	18.8
Parsnip	10	53	87.1	1
Fir (*Abies excelsa*)	76	80.1	98.9	10.7
Norway pine (*Pinus sylvestris*)	78	83.8	97.9	9.7

Determinations of the viability of weed seeds made at the Jönköping Station showed the following results: *Centaurea cyanus* 88.3 per cent, *Anthemis tinctoria* 57.5 per cent, *Cerastium vulgatum* 89 per cent, *Cuscuta trifolii* 19.5 per cent, *Bromus secalinus* 94.3 per cent, *Prunella vulgaris* 67.8 per cent, *Stellaria media* 72 per cent, and *Cirsium arvense* 1.5 per cent.—F. W. WOLL.

Additional notes on seed testing, G. H. HICKS and S. KEY (*U. S. Dept. Agr. Yearbook 1897, pp. 411–452, figs. 3*).—In continuation of previous papers published in the Yearbooks of this Department on pure-seed investigation, the authors in the present paper treat mainly of the special apparatus, methods, and expedients which have been adopted in the regular work of the Seed Laboratory of this Department. Attention is also called to the importance of field tests, which are too frequently neglected in ordinary seed-testing work.

Some methods in the study of mature seed, L. H. PAMMEL (*Jour. Appl. Micros., 1 (1898), No. 3, pp. 37–39, figs. 6*).

The choice of seed, G. BATTANCHON (*Prog. Agr. et Vit., 30 (1898), No. 44, pp. 527–531*).—The author in a semipopular article points out the value of good seed and the necessity for their selection.

On the selection of seed by their specific weight, L. DEGRULLY (*Prog. Agr. et Vit., 30 (1898), No. 42, pp. 453–455*).—The author states the general advantage accruing from the use of heavy seed and cites examples in which there was an increased yield of oats of 260 kg. grain and 360 kg. straw per hectare from the heavier seed. In the case of maize a gain of 33⅓ per cent was due to the use of heavy seed. Report of the seed-control station at Lund (Sweden) for 1897, B. Jonsson (Malmö, 1898, pp. 29).

Dodder, R. HELMS (*Producers' Gaz. and Settlers' Rec.* [*West. Australia*], *5* (*1898*), *No. 5, pp. 394–396, fig. 1*).—Notes are given on *Cuscuta trifolii*, which is parasitic on alfalfa. Spraying infested plants with a solution of iron sulphate (1 lb. dissolved in 10 gal. water), burning, mowing, and covering the affected plants several inches thick with stable manure, and thus thoroughly smothering the weed, are among the methods suggested for its eradication.

Upon the destruction of Equisetums (*Ztschr. Pflanzenkrank*, *8* (*1898*), *No. 3, pp. 175–178*).—Notes are given on the occurrence of *Equisetum palustre*, with suggestions for its eradication.

Two phanærogamous parasites of red clover, B. D. HALSTED (*Bul. Torrey Bot. Club*, *25* (*1898*), *No. 7, pp. 395–397, fig. 1*).—Notes are given on the parasitism of *Cuscuta epithymum* and *Orobanche minor* on red clover.

Orobanche speciosa, G. HENSLOW (*Gard. Chron.*, *3. ser.*, *24* (*1898*), *No. 605, p. 89*).—The author reports having observed a field of beans just outside of Cairo, Egypt, which was seriously attacked by this parasitic plant.

Weeds which afford protection to noxious insects, A. M. LEA (*Producers' Gaz. and Settlers' Rec.* [*W. Australia*], *5* (*1898*), *No. 4, pp. 286, 287*).—The author enumerates a number of weeds which serve as food plants for noxious insects and suggests a destruction of these weeds wherever abundant.

Noxious weeds, R. HELMS (*West Australian Settler's Guide and Farmer's Handbook, 1897, pt. 3, pp. 532–563, figs. 14*).—Descriptive notes are given of 68 of the more troublesome weeds, with suggestions for their eradication.

DISEASES OF PLANTS.

Peach yellows in nursery stock, G. H. POWELL (*Delaware Sta. Rpt. 1897, pp. 168–174, figs. 5*).—The author states that while inspecting nurseries in October, 1896, it was noticed that small, yellowish, willow-like shoots occurred from the buds of a considerable portion of the trees budded during the season. The general appearance of these indicated that the nursery stock was attacked by peach yellows and specimens submitted to the Division of Vegetable Physiology and Pathology of this Department confirmed the supposition. The author, however, became convinced that the general appearance was not due to peach yellows, but that its origin was to be found in the constriction caused by the inserted bud, the hot, dry weather during the budding season, and the subsequent warm rains in September, which caused a secondary growth of the wood. In four nurseries budded late in the summer and fall 32, 34, 49, and 86 per cent of the trees presented the sprouted appearance. In the nursery where 86 per cent showed this growth two buddings had been performed, as the hot, dry weather seriously interfered with the first budding. Investigations made to determine the influence of crowding, air, light, and root-foraging extent seem to indicate that the outside rows, which were subjected to greater drought on account of lack of shade, suffered the most.

When a comparison of the willowy shoots from the nursery trees was made during the month of October with those of similar size from trees known to be affected with peach yellows, several striking differences were observed. The shoots from trees with yellows were more slender, paler in color, with drooping leaves, and they had continued growing at

the tip until checked by frost, while those from the nursery stock were upright and green with a true but undeveloped terminal bud. The suspected trees were allowed to grow during the spring of 1897 and watched closely during the summer months, and in no case did any sign of yellows appear.

"The origin of the yellows-like shoots on the bodies of nursery trees that were budded in 1896 is clearly ascribed, primarily, to the partial girdle formed by the inserted bud and then to the subsequent climatic conditions which pushed forth a fall growth from the formant buds around the constriction. Buds that start early in the season grow rapidly into normal, healthy shoots, but the growing activity of the tree is greatly reduced in the fall, and the buds starting at that time develop slowly and form shoots with short nodes and small, undeveloped, light-colored leaves. These small shoots, in all probability, would have grown into strong, healthy branches had they begun their development in the summer months. . . .

"It should be said that a similar condition prevails in recently budded nursery stock, to a greater or less extent, every fall, and whenever the climatic conditions are such as to induce a fall growth in fruit trees the shoots on recently budded nursery stock will be more abundantly developed. The same phenomena may be seen in pear, plum, and apple stocks, and it is more marked in those varieties which naturally have a tendency to sucker. It can be induced by checking the growth in rapidly growing trees in a variety of ways, such as by budding, grafting, pruning, girdling, bending a branch, or by tying a string around it."

An outline plan is given of the experiments which were conducted with a view of preventing tomato diseases, but the results were so inconclusive that they are not published.

A preliminary report upon the diseases of the peach; experiments in spraying peach trees, A. D. SELBY (*Ohio Sta. Bul. 92, pp. 179–268, pls. 12, figs. 12*).—*Diseases of the peach* (pp. 179–236).—After briefly discussing the peach industry in Ohio, the author gives a report on the diseases to which the peach is subject, dividing them under the following 5 heads: Those due to mechanical agencies or unfavorable soil conditions; injury due to atmospheric conditions; diseases referred to unknown or doubtful causes; fungus diseases of the peach, and those caused by animal organisms and insects.

Among the disease due to mechanical and soil conditions, the author mentions wounds, resulting in exudation of gum, and diseased conditions caused by underdrained soil.

The injuries due to atmospheric conditions mentioned are freezing and wind storms, hail, etc.

Of the diseases referred to unknown or doubtful causes, the author mentions peach yellows, peach rosette, a twig disease accompanied with gum flow, dropsical swellings of twigs and branches, twig spots, and crown gall.

Suggestions are given for the prevention of these various diseases. Among the means for the prevention of the yellows the author recommends the destruction of all affected trees and care that tools used in digging up and destroying the diseased trees should be thoroughly sterilized so as not to communicate the disease to others. The peach

rosette, while briefly described, has so far not been demonstrated to exist in Ohio. The twig disease described, which is accompanied by an exudation of gum, affects the twigs, branches, and even the trunks of the trees. There are no evidences of previous perforations of the bark as when attacked by some bark beetle. A sectional examination of diseased branches shows a dead or injured area. The author enumerates various hypotheses as to the possible cause of this disease, but does not believe that the true cause is known. He believes, however, that some impairment of vigor or interference of normal life activities is a partial, if not complete, explanation of the cause. The disease is of a progressive nature and ultimately destroys the trees, and on this account infected ones should be quickly destroyed.

Dropsical swellings of the twigs and branches and twig spots are briefly described. No fungus or other organism has so far been found which is the probable cause of these affections. The nature and cause of crown gall does not admit of precise statements. The growth of the galls are usually soft, corky, or spongy upon the various parts of the tree. Below ground they are renewed on the peach each season, the old galls falling away and decaying, while the new ones are formed. By many authors the chief cause of these galls has been attributed to nematodes, but the author thinks this hypothesis is hardly warranted by the facts as observed. Experiments with lime, sulphur, and wood ashes have failed to cure any trees affected by crown gall, and the author suggests that any tree showing rough gall growths should be thrown out and burned.

Among the fungus diseases of the peach described are the peach rot, peach scab, brown or pustular spot, anthracnose, peach mildew, leaf curl, leaf spots, a constriction disease of the stem and branch, which is said to be due to *Phoma persicæ*, twig blight, twig spots, and a root rot. These diseases are more or less briefly characterized and so far as known remedies are suggested.

The diseases due to animal organisms, as nematodes, root borers, and root lice are briefly described.

Experiments in spraying peach trees (pp. 237–260).—The author reports a series of experiments which have been carried on for 3 years in the commercial spraying of peach orchards. These experiments are said to have fully demonstrated the practicability of spraying peach trees with Bordeaux mixture for the prevention of leaf curl, scab, and pustular spot diseases. In spraying for the prevention of leaf curl the application seemed to have a cumulative effect. The disease on trees sprayed in 1897 which had been sprayed the two previous seasons amounted only to 8 per cent.

Three applications of the fungicide reduced the amount of spotted peaches to 1 per cent, and 2 sprayings reduced the pustular spot disease to $2\frac{1}{2}$ per cent, while unsprayed trees bore 16 per cent of affected peaches. For the early spraying of trees the author recommends a

strength of solution double that which the trees would stand during the later period of the season. The cost of spraying peach trees, when conducted on as large a scale as these experiments, amounted to 1½ cts. per tree for each application. The author states that four applications can be made on fairly level orchards for less than 6 cts. per tree, this estimate covering the cost of both labor and spray materials.

Smuts and rusts of grain in Idaho and the most approved methods of dealing with them, L. F. HENDERSON (*Idaho Sta. Bul. 11, pp. 31, figs. 15*).—The author has given descriptive notes, largely compiled, of the stinking and loose smut of wheat, loose smut of oats and barley, and corn smuts, together with notes on the rusts of various cereals. For the prevention of the smut of wheat, in 1895 and 1896 experiments were conducted with different strengths of copper sulphate and the hot-water treatment. Deductions are drawn from the experiments of the first year, no record having been kept of the yield of grain and straw in the second year's tests. The plats seeded with untreated grain averaged about 86 per cent smutted grain, while those treated with different strengths of copper sulphate and those given the hot-water treatment showed that both methods were very effective in suppressing the stinking smut of wheat.

After a general discussion of the rusts of cereals the author suggests the fallowing of wheat fields as a possible method of keeping down the attacks, the fallow lands being closely pastured before plowing. Where one crop of cereals follows another the stubble and all infected straw should be burned. While all varieties of wheat seem to suffer from rusts the early ripening varieties are least affected, and those varieties with straight stiff leaves are less affected than those having weaker foliage. It is thought that the red wheats are less affected than the white varieties, notably the Velvet Chaff, which is extremely subject to attack. Poor drainage and an excess of nitrogen in the soil seems to aggravate the disease.

Concerning the red rust of the currant, J. ERIKSSON (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 3, pp. 194–201, pl. 1*).—The author studied the rust (*Puccinia ribis*) found on the fruit and foliage of red currants. The investigations disclosed the fact that this rust is a true micropuccinia, producing only teleutospores, which do not become viable until the spring after they have been formed. A so-called specialization is found also in case of this rust, which attacks red and white currants (*Ribes rubrum*), but not black currants (*R. nigrum*) or gooseberries (*R. grossularia*). The disease reappears in the spring through infection from wintered spores, after an incubation period of 29 to 39 days.

The precautions to be observed in case of an appearance of this disease are given as follows: In the fall, carefully gather, remove, and burn leaves and berries which from time to time fall from diseased bushes; in the spring, when the currant bushes are about to leaf, one

or more thorough sprayings with Bordeaux mixture are made, not only on the bushes, but on the ground under and around them.—F. W. WOLL.

The effect of benzolin and sulfurin on potato plants, R. THIELE (*Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 143-146*).—On account of the reputed fungicidal value of these insecticides the author investigated, in the summer of 1897, the effect of spraying benzolin and sulfurin on potato plants for the prevention of the potato blights. Fruit trees and *Vicia faba* were likewise sprayed.

Fifty varieties of potatoes were sprayed with these substances and it was found that the effect on the different varieties varied considerably, some plants being seriously injured, the leaves being more or less destroyed and the plants reduced in size, while others were of normal growth. Comparing the results as tabulated, it appears that while the amount of disease was somewhat reduced by the use of the fungicides, there was little difference in the action of the two, and in general the tubers from the treated plats were smaller than those from the checks.

Danger of introducing a Central American coffee disease into Hawaii, W. T. SWINGLE (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Circ. 16, pp. 4*).—The author calls attention to the presence of a very serious coffee disease in Central America, which is due to the fungus *Stilbum flavidum*. This disease attacks the plant, producing round or oval dingy yellowish gray spots on the branches, fruits, and especially on the foliage. The necessity for the inspection of all importations of plants from infested regions is pointed out.

Notes are also given on the coffee-leaf disease due to *Hemileia vastatrix*, which has about completely destroyed the coffee plantations of Ceylon, and also a disease due to nematodes, which is known in Brazil.

Phytopathological notes, F. SITENSKY (*Abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 3, pp. 148, 149*).—The author gives notes on the abnormal growth and condition of a number of plants, some of the most striking of which are herewith mentioned.

The effect of lightning on an alfalfa field is shown, in which a field in full bloom showed the day after having been struck with lightning a circle about 5 meters in diameter, where the plants were completely wilted. The effect on a pear tree, a poplar, and a larch is also given.

The occurrence of potato tubers in the axils of the leaves above ground is mentioned; wherever abundant there were no tubers found below ground.

Especial mention is given of abnormally swollen sugar and fodder beets which were found in a field the soil of which was unusually dry. The sugar content of the beets was in every case much lower than that of the mother beets.

Infection experiments were conducted with *Plasmodiophora brassicæ*, in which various species of Brassica, as well as *Cheiranthus cheiri*, *Raphanus sativus*, *Eruca sativa*, and *Erysimum crepidifolium* were successfully inoculated. The use of lime in the soil was found a good means for the prevention of this disease.

The appearance of a bacterial disease of beets is mentioned, and also experiments for the inocculation of potato blights.

Some notes are given on the occurrence of various smuts and rusts on cereals, and it is stated that spores of *Ustilago maydis*, *U. cruenta*, *U. crameri*, *Tilletia caries*, and *T. lævis* retained their power to germinate for, at the most, two or three years.

Fungi on the wheat plant, D. McAlpine (*Agr. Gaz. New South Wales, 9 (1898), No. 9, pp. 1009–1015, pl. 1*).—Notes several species, some of which are new to science.

Notes on the variation of the teleutospores of Puccinia windsoriæ, J. A. Warren (*Amer. Nat., 32 (1898), No. 382, pp. 779–781, pl. 1*).—The author reports collecting this fungus on *Muhlenbergia racemosa*, and examinations of the material showed the teleutospores as having 1 to 4 cells instead of the normal 2 cells. Other variations are noted.

Cracking of pears and apples (*Gard. Chron., 3. ser., 14 (1898), No. 610, p. 611, figs. 3*).—Descriptive notes are given of the injury due to *Fusicladium dendriticum*, and 2 or 3 applications of Bordeaux mixture are recommended as a preventive treatment.

Potato scab, W. G. Smith (*Gard. Chron., 3. ser., 24 (1898), No. 621, p. 372*).—In a paper read before the Royal Horticultural Society the author described the potato scab and commented upon the various assigned causes and the use of corrosive sublimate, sulphur, and kainit as preventive measures.

The gooseberry fungus, H. T. Soppitt (*Gard. Chron., 3. ser., 24 (1898), No. 608, p. 145, fig. 1*).—The author describes *Æcidium grossulariæ* and mentions the discovery of Klebahn, that the uredospore and teleutospore forms occur on *Carex acuta* and *C. goodenorii*, the fungus being designated as *Puccinia pringsheimiana*. The author reports experiments in which the spores were transferred from the gooseberry to various species of Carex and, while no results were obtained on either *Carex hirta* or *C. leporina*, the infected plants of *C. goodenorii* produced a promising crop of teleutospores.

A peony disease, G. Massee (*Gard. Chron., 3. ser., 24 (1898), No. 607, pp. 124, 125, fig. 1*).—The author describes a disease caused by *Botrytis* sp., and as preventive measures recommends the following:

"Remove and burn all drooping stems the moment the first symptoms are observed. Where the disease has previously existed, or better, under any circumstances, remove the surface soil early in spring, and replace with fresh soil mixed with quicklime. Do not use green manure as a top-dressing. The mycelium of the fungus is not perennial in the root of the peony, so that it starts life perfectly free from its enemy each year, and can only become diseased through inoculation from sclerotia lying in the soil, from germs contained in manure, or from floating summer spores borne from some diseased plant grown in the neighborhood."

Stem rot of carnations, W. E. Britton (*Amer. Florist, 14 (1898), No. 545, pp. 431, 432*).—Brief notes are given of an attack of *Fusarium* sp. on the stems of carnations, causing their rotting. The disease is not prevented by Bordeaux mixture and seems liable to attack snapdragons and antirrhinums. The author for the present recommends destroying all diseased plants and propagating only from healthy stock.

A disease of phlox, P. Nypels (*Bul. Soc. Belge Micros., 24 (1897–98), pp. 123, 124*).—Reports the occurrence of *Tylenchus devastatrix*.

A disease of the La France rose, H. C. Haas (*Rosen Ztg., 13 (1898), No. 5, pp. 80, 81*).—A brief report is given upon a disease which has been noted for at least four years on the La France rose. The author claims to have made a thorough examination of the roots of the plant and found them sound, and thinks that the disease is probably due to some fungus. The principal point of attack seems to be at the crown of the plant.

A monograph of the Peronosporaceæ, A. N. Berlese (*Riv. Pat. Veg., 7 (1898), No. 1–4, pp. 19–37*).—This is in continuation of a previous paper, and treats of the life history of the mildews, means of combating them, systematic arrangement, etc.

Infectious diseases of cultivated plants according to strict bacteriological methods, E. HALLIER (*Die Pestkrankheiten der Kulturgewächse. Stuttgart: E. Nägele, 1898, 2. ed.*).

The bacteria of sorghum blight, F. F. BRUYNING (*Arch. Neerland. Sci. Exact. et Nat., 2. ser., 1 (1898), pp. 297–330, pls. 2; abs. in Jour. Roy. Micros. Soc., 1898, No. 5, p. 581*).—Two new species of bacteria are described from blighted sorghum. They are *Bacillus ruber ovatus* and *Micrococcus aurantiacus sorghi.*

Notes of some plant diseases, G. POLLACCI (*Atti R. Univ. Pavia, 2. ser., 5 (1897), pp. 8; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 3, p. 171*).—The author notes the occurrence in the botanical garden of Pavia of the following parasitic diseases: *Macrosporium violæ*, on the leaves of violets, *Helminthosporium iberidis* on the leaves of *Iberis* sp., *Leptothyrium parasiticum* on the stems of the *Cereus stellatus* and *C. triangularis*, *Cytosporella cerei* on *Cereus* sp., *Pirostoma farnetianum* on *Pandanus utilis*, *Phyllosticta dammaræ* on the leaves of the *Dammara moori*, and *Helminthosporium lunariæ* on the leaves of *Lunaria biennis*. The last-named fungus causes the total destruction of the fundamental parenchyma of the leaves, causing them to fall.

The principal nematodes found on agricultural crops, E. HENNING (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 4, pp. 247–265, ill.*).

On the occurrence of Heterodera schachtii and H. radicicola in Russia, J. TARNANI (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 2, p. 87; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 3, p. 165*).—The author reports the presence of *Heterodera schachtii* upon beets and also *Sinapis nigra*, *Poa annua*, *Trifolium repens*, *Medicago lupulina*, *Stellaria media*. *Solanum nigrum*, *Chenopodium polyspermum*, *Triticum repens* and *Sonchus oleraceus*. Of the last three plants their use as catch crops for beet nematodes can hardly be further recommended.

Upon the sugar beet the author found also *Heterodera radicicola*, *Dorylaimus* sp., and *Enchytræus* sp.

Heterodera radicicola has been reported in a number of places in different governments of Russia as occurring on sugar beets and *Oxalis stricta*, *Sonchus arvensis*, *Galinsogea parviflora*, *Papaver rhoeas*, and *Polygonum* sp.

Protection of fruit against parasitic fungi, A. TSCHOKKE (*Landw. Jahrb. Schweiz, 11, p. 153; abs. in Gard. Chron., 3. ser., 24 (1898), No. 621, p. 370*).—It is stated that pomaceous fruits are protected against invasions of such fungi as *Monilia fructigena*, *Penicillium glaucum*, *P. olivaceum*, *Mucor pyriformis*, and *M. stolonifer* by the transformation of the stomata into lenticels and by the presence of tannic and malic acids in the peripheral layers of cells.

A remedy for Glœsporium læticolor, W. BUTTON (*Gard. Chron., 3. ser., 24 (1898), No. 603, p. 53*).—The author states that spraying grapes with methyl alcohol has proved successful in the destruction of this fungus. Care must be taken that the alcohol is not sprayed on the grapes so as to form drops on the berries, or it will produce decay. It is advised that the application be made either during a dull day, with little air stirring, or when the sun is not shining on the vines.

Treatment of plant diseases in 1896, F. D. CHESTER (*Delaware Sta. Rpt. 1897, pp. 20–38, figs. 4, dgms. 5*).—This is a reprint of Bulletin 34 of the station (E. S. R., 9, p. 147).

Instructions for spraying, J. H. PANTON (*Rept. Agr. New Brunswick, 1897, pp. 209–222, figs. 13*).—Formulas for fungicides and insecticides are given and a number of injurious insects and fungus diseases are described.

On the contamination with copper through pressing of sprayed grapes, H. HOFFMANN (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 9, pp. 369–376; 10, pp. 422–427*).

ENTOMOLOGY.

Preliminary notes on the codling moth, T. D. A. COCKERELL (*New Mexico Sta. Bul. 25, pp. 47–68*).—The bulletin gives the results of one year's observations on the codling moth in New Mexico. The life history of the insect at Mesilla is as follows: Moths appear toward the end

of April and lay their eggs on or near the small apples. A few small worms are found the second week of May and are numerous the latter half of May, some maturing by the last of the month. By the middle of June most of the first brood have left the apples, and by the last of the month some appear as moths. By July 10 the second brood of worms are working in full force. The third brood of worms are working by the second week of August, and by the third week some have pupated. By this time the broods are scarcely separable, since the late worms of the second brood are scarcely ahead of the early worms of the third. In September a partial fourth brood of worms appears, but the large proportion of the third brood winter as larvæ.

From observations with different varieties of apples the author believes it is still an open question whether the codling moth prefers one variety to another. In some cases there were great differences between individuals of one variety, old trees with rough bark being more affected than young smooth trees.

The insects pupate beneath the bark or in cracks on the trunks and limbs. A small proportion of the summer larva pupate in depressions on the fruit or between adjacent fruits.

The natural enemies of the codling moth are discussed. Among birds the most destructive to the insect are thought to be the 2 woodpeckers *Colaptes cafer* and *Picus scalaris*. Bats are thought to catch many of the moths. Hymenopterous parasites of the codling moth have not been found in the locality of the station, and have only rarely been found in other places in the State. The larva of a beetle, thought to be *Cymatodera cylindricollis*, is found in moderate numbers and preys on the codling worms after they hide under the bark of the trees. Several cases of a parasitic fungus similar to the chinch-bug fungus (*Sporotrichum globuliferum*) were found. On the whole, the author believes that only a limited amount of relief from the ravages of the codling moth is to be expected from its natural enemies.

The object of remedies in New Mexico is to prevent injury to the late apple crop, since the early crop is never seriously injured. Putting Paris green under bands on the trees in an attempt to poison the larvæ after they leave the fruit resulted in no success. Searching after worms on the trees in early spring gave fair results. Many of the worms were found, not under the bark, but in cracks in the partly dead wood of the trees, where they were safe from the attacks of birds. The author recommends, therefore, that all dead wood be cleared away and the cracks that remain be filled with wax or other suitable substance. He also emphasizes the importance of destroying worms in the storage house, and notes the case of a single cellar used as storage for apples in which over 5,000 worms were killed. Picking off and destroying wormy apples in the early summer was thought beneficial, but did not save the late crop. Trapping the larvæ under bands of paper placed about the tree trunks proved quite successful. Of 220 worms found on trees July 20, 204 were under bands. Pasturing hogs in the orchard to eat

the wormy windfalls is recommended. Spraying as ordinarily recommended is thought to be ineffectual. The author discusses the plan of destroying a year's fruit crop with the idea of exterminating the insect. In the locality of the station there were found no wild food plants on which the worms could subsist. The fact is noted that the early fruit, including all kinds of apricots, many peaches, plums, and cherries, and some apples would not have to be destroyed. This remedy would result in little good unless it were undertaken by all fruit growers.

A new orchard pest—the fringed-wing apple-bud moth, J. M. STEDMAN (*Missouri Sta. Bul. 42, pp. 36–53, figs. 10*).—The author reports the discovery of a new bud moth, which Mary E. Murtfeldt has referred provisionally to the genus *Nothris* and given the specific name *maligemmella*. The egg is oval, 0.6 mm. long and 0.35 mm. broad, of a uniform light yellow color, "with the surface thrown into small shallow depressions and elevations which become larger and deeper at one end, in the center of which there is a protuberance or very short peduncle." The larvæ at first has a light-yellow color with shining black head and seal brown shield on the dorsal part of the first thoracic segment. The body is sparsely clothed with light-colored hairs. The true legs are brown and the five pairs of pro-legs are light yellow and are borne by the sixth, seventh, eighth, ninth, and last segments. When older the larvæ becomes light-greenish yellow in color with the shield on the dorsal part of the first thoracic segment shining black. When full grown it is about 8 mm. long and the color of the true legs, head, and shield become lighter until they are light yellow like the body. The pupa, inclosed in a thin, white, silken coccoon, "is 5.5 mm. in length and 2 mm. in width, of a uniform brown color and with a row of small, almost round depressions along each side of the sutures between the last five abdominal segments, and with indications of depressions in the form of markings along the sides of the other abdominal sutures." The moth is described by Mary E. Murtfeldt as follows:

"Alar expanse 14 to 15 mm. General color, satiny brownish buff with slight opalescence, and more or less leaden shading on thorax, wings, and body. Head buff, densely and somewhat shaggily scaled. Eyes prominent, purple black. Antennæ two-thirds as long as wings; basal joint conspicuously long and stout; second joint also long with the inner side peculiarly excavated. Palpi (labial) long recurved with short almost concealed basal joint, long slightly thickened second joint and slender tapering terminal. Thorax broad; patagia rather large, all anteriorly bordered with leaden gray. Forewings varying in color from almost clear buff to buff, so interspersed with the darker scales as to produce a 'smudged' effect; a small but distinct black discal dot and a group of five smaller, less clearly defined ones at the base of the terminal third constitute the ornamentation. Hind wings rather broad, somewhat paler and more lustrous than the primaries. Fringes concolorous with wing surface, also varying in intensity of the dark shadings. Body yellowish gray with bright-buff anal tuft. Legs agreeing in color with under surface, tibia, especially of hinder pair, densely clothed with long but oppressed hairs."

[The author says:]

"The moth is increasing rapidly and infesting new areas, but thus far it has been found in the western part of this State only, although it will, no doubt, soon become

general throughout Missouri and eastern Kansas. It accomplishes its injury in the spring by the larvæ eating into both the leaf and flower buds while they are unfolding, and ultimately causing them to drop at about the time, or shortly after, the flowers (petals) fall."

The following directions are given for combating the insect:

"Although this pest is a difficult one to combat owing to its habits of feeding within the young developing and unopened leaves, we were successful in holding it in check and in preventing the greater percentage of the fruit buds from being destroyed by early, thorough, and frequent applications of Paris green. The mixture to be used for this insect is: One pound of pure Paris green, 3 lbs. of fresh lime, and 150 gal. of water. The mixture must be constantly stirred while spraying, and the work done thoroughly on both sides of the tree. The first application is to be made as soon as the buds open and the green leaves first appear sufficiently to give the tree a green tinge, the second application about 5 days later, and the third at the time the first flower buds are about to open."

A new breeding cage used in the study of the fringed-wing apple-bud moth is described and illustrated.

The peach-twig borer, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 7-20, figs. 5*).—This article discusses the origin and distribution of the peach-twig borer (*Anarsia lineatella*), its characteristics, life history, and habits, natural parasites, remedies to be used against it, etc. It is pointed out that the strawberry-crown miner, which has been supposed to be identical with the peach-twig borer, is a distinct insect.

As a remedy the author recommends winter treatment with kerosene emulsion, resin wash, or some similar oily preparation which will penetrate the burrows and kill the young larvæ. The use of arsenical sprays in spring and fall is noted, but the operator is cautioned to use only weak sprays—1 lb. of the poison with an equal amount of lime in 200 gal. of water—to prevent scalding the very sensitive peach foliage. Removal and burning of withering infested tips of the trees in the spring as soon as injury is noted is thought to be often impracticable or even of doubtful utility.

A bibliography of the principal writings on the peach-twig borer is given.

The quince curculio, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 148, pp. 695-715, figs. 10*).—The quince curculio (*Conotrachelus cratægi*) is considered the most serious enemy of the quince in New York. "During the past few years this quince curculio has caused a greater monetary loss to some of the larger quince growers in western New York than all the other insect foes and fungus diseases of the quince combined." The history, distribution, food, life history, habits, appearance, and natural enemies of the insect are given. It breeds in the wild haws and often attacks pears, but has a special liking for quinces. It is not known to breed in apples. Picking off and destroying infested fruit is impracticable, since it is often difficult without mutilating the fruit to determine whether it is infested. "The experience of some of our largest and most successful quince growers who

have cultivated their orchards thoroughly, both in the fall and spring, for several years proves quite conclusively that cultivation has but little, if any, effect in reducing the numbers of the curculio." Tests in an insectary indicated that the unsuccessful cultivation is due to the fact that the grubs bore back into the soil however often they may be disturbed. The chances of poisoning the insect by spraying are small. The egg is deposited in the flesh so that the larvæ can not be reached. The beetle can be poisoned only during the week or more spent in feeding on the fruit at the egg-laying period, and it gets most of its food in the flesh, eating only a minute hole through the skin. In the case of an orchard at Lockport, New York, hogs seemed to keep the insect in check. The author recommends the jarring method commonly used against the plum curculio as the most successful remedy known at present. A curculio catcher, especially adapted to the low-growing habit of the quince, is illustrated.

The San José scale in Missouri, J. M. STEDMAN (*Missouri Sta. Bul. 41, pp. 17-35, figs. 8*).—An inspection of the principal nurseries and some of the larger commercial orchards of Missouri is reported. The San José scale was not found in any nursery, but was present in twenty orchards, some of which are already completely ruined. In most cases the scale was introduced 7 years ago, one infection however occurring only 2 years ago. The distribution of the scale in Missouri as at present known is shown by a map. The scale is described and figured. As a remedy for the scale in orchards whale-oil soap, applied two or three times after the trees have been severely pruned, is strongly recommended.

Digestion in the larvæ of the gypsy moth, A. H. KIRKLAND and F. J. SMITH (*Agr. Massachusetts, 1897, pp. 391-401*).—The article notes the food materials of the gypsy moth, describes the moth's digestive system, and discusses its digestive processes.

"Microscopic examinations of the contents of different parts of the alimentary canal show that the greater part of the food retains much of its original physical character. The fibrous elements pass through the system practically unchanged. The softer tissues undergo a partial disintegration, but in general the cellular structure can be recognized. In the contents of the cells, however, there is a great change; in food removed from the anterior stomach the cell contents showed only a partial destruction, while in samples from near the intestine the protoplasm had nearly disappeared, only the chlorophyll granules remaining. From these examinations it appears that the process of digestion in this larva is practically one of solution or extraction; the digestive fluids dissolve the soluble proteids, carbohydrates, fats, salts, etc., while the insoluble parts are eventually ejected."

The alkalinity of the digestive fluids of the gypsy moth larvæ is ascribed to the presence of tri-potassium phosphate. Analyses of the alimentary canals of a number of lepidopterous larvæ showed that "phosphate of potash, although varying in amount, is a constant ingredient of the digestive fluids of leaf-eating Lepidoptera." The author believes that the function of this compound is "to aid in the osmosis of albuminoids through the walls of the alimentary canal into

the blood." Some lines of experiments with insecticides based on the presence of potassium phosphate in the digestive fluids of the gypsy moth larvæ are suggested.

Arsenate of lead: Its manufacture and chemical composition, F. J. SMITH (*Agr. Massachusetts, 1897, pp. 357–369*).—Arsenate of lead suitable for spraying is prepared from commercial grades of arsenate of soda and either acetate of lead or nitrate of lead. The proportions and properties of these ingredients are described. The lead oxid content was found to vary from 58.81 per cent to 66.795 per cent in 8 samples of acetate of lead, and from 66.37 per cent to 68.37 per cent in 3 samples of nitrate of lead. Four samples of arsenate of soda showed a variation of 36.77 per cent to 47.8 per cent in arsenic pentoxid. It also varied in percentages of chlorin and other foreign substances. The chemical composition and properties of arsenate of lead and the chemical actions involved in the preparation are given in detail. Formulas are given for computing the quantities of acetate of lead and arsenate of soda required to prepare a given quantity of arsenate of lead.

Danger from the use of arsenate of lead, A. H. KIRKLAND (*Agr. Massachusetts, 1897, pp. 390–393*).—Analyses were made of the urine of men engaged in extensive spraying operations against the gypsy moth.

"The results of these analyses show conclusively that in some cases men engaged in spraying acquire dangerous amounts of arsenic. That actual sickness resulting from this work is rare is shown by the fact that but few of our many employees lost time from this cause. . . . It may be stated, in general terms, that while an occasional person may become poisoned during extensive spraying operations with arsenate of lead, premonitory symptoms appear in ample time for a change of work to be arranged; and since the conditions existing in the work against the gypsy moth are exceptional, the farmer or fruit grower may use this insecticide with less fear of danger from poisoning than is the case where Paris green or London purple is used. In all cases proper care must be taken in handling the poison and in preventing the exposure of the skin to the spray."

Concerning the direct combating of phylloxera on stock, C. MOHR (*Ztschr. Pflanzenkrank., 8 (1898), No. 2, pp. 69, 70*).—The author recommends the use of 0.5 liter benzolin in 100 liters of water, to be made neutral to litmus paper with sulphuric acid. This mixture is to be poured about the roots of the infected plants, 10 to 15 liters being used for each plant. It is further stated that this solution can be used with benefit for destroying various forms of plant lice on many other plants.

Experiments with insecticides, A. H. KIRKLAND and A. F. BURGESS (*Agr. Massachusetts, 1897, pp. 370–389*).—Both indoor and outdoor tests of the relative value of various insecticides in killing gypsy moth larvæ are reported. The data obtained are reported in tabular form. Some of the conclusions are as follows:

"While arsenic seems slightly superior to Paris green so far as killing effects are concerned, its high specific gravity renders it difficult of suspension in water, and hence it can not be applied evenly to the foliage. . . . Experiments with chemically

pure arsenite of lead *v.* arsenate of lead mixture (containing in reality only about 50 per cent chemically pure arsenate of lead) show the relative superiority of the latter. The specific gravity of the arsenite of lead is much greater than that of the arsenate, and for this reason it can not be so evenly applied to the foliage. . . . The experiments with barium arsenate in 1896 gave so good results that we were hopeful that this insecticide would prove superior to lead arsenate. Its killing effects on larvæ in confinement are certainly superior to those of arsenate of lead. In the field spraying operations it was found that the poison did not adhere to the foliage for a sufficiently long time to kill the larvæ. With the lessening of the cost of arsenate of lead we have now effected, barium arsenate can not compete with it."

Phenolate of lead had no effect on larvæ or foliage. Di-plumbic arsenate seemed equal if not superior to tri-plumbic arsenate.

Some spraying mixtures, G. W. CAVANAUGH (*New York Cornell Sta. Bul. 149, pp. 719–721*).—Chemical examination of 5 samples of Paris green showed from 54.32 to 55.32 per cent of arsenic, and an analysis of English purple showed 36.75 per cent of arsenic and 5.36 per cent of arsenic soluble in water. Two samples of Paris purple gave a total of 34.1 and 47.05 per cent of arsenic and 13.88 and 11.86 per cent of arsenic soluble in water.

An analysis of laurel green gave 10 per cent copper and 7.75 per cent arsenic (As_2O_3). Several analyses of Bug Death are given, which show that it contains no arsenic, but is made up of zinc 76.5 per cent, lead 9.8, and iron oxids 7.8 per cent, a very small amount of phosphoric acid and potash (2 per cent). The last 2 constituents give Bug Death a slight fertilizing value.

Animal parasites, R. HELM (*Producers' Gaz. and Settlers' Rec. [West Australia], 5 (1898), No. 3, pp. 189–194, figs. 7*).—A description and life history is given of bot flies of cattle (*Hypoderma bovis* and *Hypoderma lineata*) and camel bot (*Cephalomyia maculata*).

The evolution of Hypoderma bovis, according to new investigations, L. GEDOELST (*Rev. Gén. Agron., 7 (1898), No. 11, pp. 492–496*).

The life history of Hypoderma bovis, SCHNEIDTEMÜHL (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 1, pp. 30, 31*).

The Buffalo gnats, or black flies, of the United States, D. W. COQUILLETT (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 66–69, figs. 2*).—Descriptions and synopsis of the family Simuliidæ.

Further notes on the house fly, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 63–65*).—Experiments in mixing various substances with horse manure in order to prevent the breeding of house flies in it are reported. It was found that nothing was to be gained by the use of air-slaked lime, land plaster, or gas lime. Both chlorid of lime and kerosene were successfuly used, and the author expresses the belief that the latter is an easy and cheap method of treating manure piles to prevent the breeding of house flies.

The cecidomyids of cereals and their parasites, P. MARCHAL (*Ann. Soc. Ent. France, 66 (1898), No. 1, pp. 1–105, pls. 8, figs. 9; abs. in Zool. Centbl., 5 (1898), No. 18–19, pp. 618–620*).—Studies were made of *Mayetiola (Oligotrophus) destructor, M. avenæ, Cecidomyia cerealis, C. culmicola, C. frumentaria, Diplosis tritici, D. mosellana, D. equestris, D. marginata, D. flava, D. cerealis, Lasioptera cerealis,* and *Epidosis cerealis;* the most of the studies being made on the first species.

Among the parasites mentioned are: *Triacis remulus, Polygnotus minutus, P. zozini, Eupelmus atropurpureus, Merisus destructor,* and *Homoporus laniger.*

The Hessian fly in Sweden (Cecidomyia tritici), H. TEDIN (*Landtmannen, 9 (1898), No. 35, pp. 559–561*).

Insects injurious to the cranberry and other fruits, C. H. FERNALD (*Agr. Massachusetts, 1897, pp. 141–162*).—The greater part of the damage to cranberries in Massachusetts is caused by the following 3 insects: The vine worm (*Rhopobota vacciniana*), the fruit worm (*Mineola vaccinii*), and the cranberry spanworm (*Ematurga faxonii*). The habits of these insects are discussed and remedies for them suggested. A few other cranberry insects of less importance are noted. The author also discusses plant lice and the San José scale and suggests treatment.

Two Japanese insects injurious to fruit, M. MATSUMURA (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 36–40, figs. 2*).—The apple-fruit borer (*Laverna herellera*) and the pear-fruit borer (*Nephopteryx rubrizonella*) are described and notes are given on remedies.

The peach-twig borer, C. L. MARLATT (*U. S. Dept. Agr., Farmers' Bul. 80, pp. 15, figs. 5*).—This is a revised reprint from U. S. Dept. Agr., Division of Entomology, Bulletin 10, new series (see p. 565).

Three shade-tree insects, A. H. KIRKLAND (*Agr. Massachusetts, 1897, pp. 238–247, figs. 5*).—The author discusses the sugar-maple borer (*Plagionotus speciosus*), the oak pruner (*Elaphidion villosum*), and the imported elm-bark louse (*Gossyparia ulmi*), considering such points as life history, injury, natural enemies, remedies, etc.

Notes on the strawberry weevil: Its injuries and bibliography, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 82–87*).

The fig eater, or green June beetle, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 20–26, fig. 1*).—This gives notes on the characteristics and habits of the green June beetle (*Allorhina nitida*). It is shown, contrary to the general belief, that the normal food of the larvæ of this beetle is the vegetable mold of rich soils and that in its larval stage it is not a crop pest.

Scale insects, A. M. LEA (*Producers' Gaz. and Settlers' Rec. [West. Australia] 5 (1898), No. 6, pp. 465–483, pls. 3, figs. 15*).—Notes are given on the San José scale (*Aspidiotus perniciosus*), red scale (*A. aurantii*), greedy scale (*A. rapax*), black aspidiotus (*A. rossi*), mussel scale (*Mytilaspis pomorum*), mussel scale of citrus fruits (*M. citricola*), black scale (*Lecanium oleæ*), broad or soft scale (*L. hesperidum*), cottony-cushion or fluted scale (*Icerya purchasi*), mealy bugs (*Dactylopius* spp.), etc.

The subject of parasitism of scale insects is discussed at some length and various remedies suggested for the destruction of the scales by means of washes and emulsions.

Monograph of the genus Aspidiotus, G. LEONARDI (*Riv. Patol. Veg., 7 (1898), No. 1–4, pp. 38–86, figs. 18*).

American scale insects as a menace to European fruit culture, A. BERLESE and G. LEONARDI (*Riv. Patol. Veg., 6 (1898), No. 11–12, pp. 321–352, figs. 21*).

Scale insects on cacti, KUHLGATZ (*Monatsschr. Kakteenkunde, 8 (1898), No 11, pp. 166–170, pl. 1*).—One of a series of articles on scale insects, together with a description of *Rhizococcus multispinosus* nov. spec.

Destructive locusts in 1897, W. D. HUNTER (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 40–53*).—This is a report of observations made in an exploration of the territory within the limits of the permanent breeding ground of the Rocky Mountain locust and adjoining territory. The activity of the Rocky Mountain locust throughout the entire breeding region was greater than for many years. The species was present in northwestern Wyoming, the larger part of South Dakota, and the northern half and western third of Nebraska, the situation being serious in some of these places, especially South Dakota. The nonmigratory locust was unusually abundant in South Dakota, Nebraska, and parts of Oregon and Washington.

The tobacco flea-beetle, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 79–82, fig. 1*).—This gives recent observations on the larval habits

of the tobacco flea-beetle (*Epitrix parvula*), a description of the larvæ and pupa and notes on the published habits and injuries of this insect.

On the habits of the Oscinidæ and Agromyzidæ reared at the United States Department of Agriculture, D. W. COQUILLETT (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 70–79*).

Notes on cucumber beetles, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 26–31, figs. 2*).—The striped cucumber beetle (*Diabrotica vittata*) and the twelve-spotted cucumber beetle (*D. 12-punctata*) are described and notes are given on their life history and habits.

Insects that affect asparagus, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 54–62, fig. 1*).—This consists of brief notes on numerous species of lepidoptera and hemiptera found on asparagus and more extended notes on the common asparagus beetle (*Crioceris asparagi*) and twelve-spotted asparagus beetle (*C. 12-punctata*).

The sugar-cane borers of Java, L. ZEHNTNER (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 32–36, figs. 4*).—This is a résumé of the results of studies made at the experiment station at Pasoeroean, Java, during the past few years. The results were published in the *Mededeelingen van het Proefstation Oost Java.*

The following borers are considered: *Diatræa striatalis, Scirpophaga intacta, Chilo infuscatellus,* and *Grapholitha schistaceana.*

The pine geometer moth (Fidorcia piniaria), S. MACDOUGALL (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 106–123, figs. 3*).—Description, life history, and food habits of this insect are given and remedial measures are suggested.

Two parasites of sugar cane, E. BORDAGE (*Rev. Agr. Reunion, 2 (1898), No. 4, pp. 400–403*).—Notes the occurrence of larvæ of *Dendroneura sacchari* and *Grapholitha schistaceana* in cane.

Report of the State Board of Agriculture on the work of extermination of tbe gypsy moth (*Agr. Massachusetts, 1897, pp. 307–350, pls. 4*).—This contains the reports of the financial agent, the entomologist, and the field agent of the Board of Agriculture of Massachusetts. The article reports what has been done in the work of extermination of the gypsy moth and describes the present conditions of the infected regions.

Notes on predaceous beetles, A. F. BURGESS (*Agr. Massachusetts, 1897, pp. 402–411*).—Notes are given on the life history and habits of several beetles which prey upon the larvæ of the gypsy moth.

The species of Podisus occurring in the United States, A. H. KIRKLAND (*Agr. Massachusetts, 1897, pp. 412–439, pl. 1*).—Descriptions of the species Podisus occurring in the United States and notes on their habits are given, together with a synopsis of the species, synonymy, etc.

Danger of importing insect pests, L. O. HOWARD (*U. S. Dept. Agr. Yearbook 1897, pp. 529–552, figs. 19*).—Of the 73 species of insects most injurious in the United States 37 have been undoubtedly introduced from foreign countries. The great majority of introduced species have come from Europe. The author regards nursery stock as the most dangerous means of importation of insect pests. Foreign insects liable to be imported are figured and discussed.

Notes from correspondence (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 97–99*).—Brief miscellaneous notes, taken from correspondence, on the following subjects: *Datana angusii* injuring pecans in Mississippi; abundance of *Catocala lacrymosa* at Brookhaven, Mississippi; the pear-tree borer in Mississippi; remedy for cabbage worms; the rice grub beetle at electric lights in New Orleans; injury by the bark beetle (*Dendroctonus rufipennis*); injuriousness of *Pieris protodice;* injury by the silver-pine tortricid to Douglas spruce in Oregon; *Heterocampa manteo* on oak; the malodorous carabid (*Nomius pygmæus*) in Oregon; voracity of *Hippodamia glacialis;* injury to chrysanthemums by *Corythuca irrorata;* a psyllid (*Trioza diospyri*) injuring Chinese persimmons; plant-lice injury to tomato; parasites of goats; the house crab spider as a destroyer of flies, and a wasp parasite.

General notes (*U. S. Dept. Agr., Division of Entomology Bul. 10, n. ser., pp. 87–97, fig. 1*).—A peculiar damage to the fruit of the apple from an unknown species of leaf miner is noted. A new case of an insect boring into lead is reported. Notes are given on *Icerya purchasi* in Portugal and the Azores; a little-known tineid moth of indoor habits; a moth likely to be mistaken for *Tinea granella;* parasites of bean and cowpea weevils; injury by the western flea-beetle, *Phyllotreta pusilla,* the windrow remedy for blister beetles; white grubs of *Allorhina nitida* invading a cellar; reported damage by the green plant-bug, *Lioderma uhleri;* on the food habits of the harlequin cabbage bug; food plants of the "cotton stainer;" collecting locust eggs in Morocco; poisoning grasshoppers in Natal, and collecting grasshoppers in New Hampshire.

Report of the director of the Entomological Institute of Sweden for 1897, S. LAMPA (*Meddel. K. Landtbr. Styr., 1898, No. 46, pp. 48, figs. 9*).

Report of the entomologist, G. H. POWELL (*Delaware Sta. Rpt. 1897, pp. 198–210*).—A brief note is given on the study of the strawberry root-louse (*Aphis forbesi*) and Bulletin 33 of the station is reprinted (E. S. R., 9, p. 73) with the addition of some data collected since its publication.

Insecticides, KITCHEN (*Florists' Exchange, 10 (1898), No. 52, p. 1258*).—A discussion of methods of applying various insecticides and of their action on the insects and plants treated and on the operator.

FOODS—ANIMAL PRODUCTION.

Fresh and refrigerated meats, A. GAUTIER (*Rev. Hyg., 19 (1897), pp. 289–303; 391–415*).—On the basis of statistics of the amount of food brought into Paris between the years 1880 and 1890 the daily amount consumed per man is calculated. A study is reported of fresh and refrigerated or frozen beef and mutton. The preserved mutton and beef came from the Argentine Republic, and had been frozen from five to six months. The samples analyzed were freed as far as possible from tendon and visible fat. The results follow:

Composition of fresh and refrigerated beef and mutton.

	Mutton (shoulder and neck), fresh.	Beef (rump steak), fresh.	Refrigerated mutton.	Refrigerated beef.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	74.92	74.75	73.66	73.96
Globulin (with a little albumen) in the portion of meat soluble in water	3.32	3.06	2.14	2.69
Preexistent peptones	1.33	2.24	1.29	2.56
Myosin	8.31	10.96	10.33	9.29
Myostroin	4.49	4.30	4.94	6.41
Indigestible matter (elastin, keratin, etc.)	.86	.24	.75	.94
Extractive materials (ferments, leucomaines, etc.)	.49	.97	.95	1.01
Glycogen	.40	.38	.03	.16
Fat and cholesterin	5.23	1.97	5.38	2.04
Soluble salts	.60	.65	.53	.47
Insoluble salts	.65	.44	.44	.44
Total	100.52	99.96	100.24	100.02

In addition, the author made the following determinations in the same samples of meat:

Constituents of fresh and refrigerated beef and mutton.

	Mutton (fresh).	Beef (fresh).	Mutton (refrigerated).	Beef (refrigerated).
	Per cent.	Per cent.	Per cent.	Per cent.
Dry matter in material soluble in cold water	5.84	6.92	5.34	6.99
Dry matter in material soluble in cold water after removal of albumen and globulin by coagulation by heat	2.523	3.86	3.20	4.50
Dry matter in bouillon obtained by boiling chopped meat in an excess of water	3.37	3.98	3.62	5.17
Reducing substance calculated as glycoses	.191	.24	.17	.11
Gelatine obtained by heating portions insoluble in water 6 hours at 115°	2.72	2.56	2.69	2.15
Nucleinic acid	.56	.44	.59	.66
Acidity of aqueous extract of 100 gm. meat calculated as sulphuric acid			.38	.40

The different constituents of the samples are discussed in some detail. According to the author, the mineral matter in the fresh mutton and beef had the following composition:

Composition of ash of fresh mutton and beef.

	Mutton.	Beef.
Soluble portion:	Per cent.	Per cent.
Potassium chlorid	0.103	0.112
Sodium chlorid	.021	.023
Potassium sulphate	.050	.055
Potassium phosphate (PO_4K_2H)	.383	.409
Calcium phosphate	.010	.018
Magnesium phosphate	.033	.036
Insoluble portion:		
Calcium phosphate, Magnesium phosphate	.650	.440
Total	1.250	1.093

A kilogram of beef was boiled for a long time in 2,500 cc. of water. One liter of beef bouillon contained 18.4 gm. dry matter, made up as follows:

	Grams.
Peptones and propeptones	5.3
Gelatinoids	2.6
Creatin and similar bases	1.8
Other bases	.2
Inosit and glycogen	1.4
Various extractives	2.6
Mineral salts	4.5
Total	18.4

The juice which exuded from fresh and frozen meat when it was allowed to stand was also studied in some detail. More juice was obtained from beef than from mutton. Thus, when a kilogram of beef was exposed to the air three days at a temperature of 13–14° C., 33 cc. of juice was obtained; from refrigerated beef 113 cc., and from refriger-

ated mutton 58 cc. This meat juice has the following percentage composition:

	Per cent.
Globulins precipitated by an excess of a saturated solution of ammonium sulphate	4.23
Albumin coagulable at 100° after removal of the globulins	1.20
Peptones	3.47
Collagen, coagulable at about 37°	.49
Other organic materials, ferments, etc	.45
Soluble salts	1.29
Insoluble salts	.06
Water	88.81
Total	100.00

Somewhat extended experiments by methods of artificial digestion are also reported with the different sorts of meat. From the investigation as a whole the author's principal conclusion is that the importation of refrigerated meat should be increased, since such meat is of satisfactory composition, is easily digestible, and may be kept for an indefinite time. The economic importance of refrigerated meat is discussed at some length.

Nutrition investigations in New Mexico in 1897, A. GOSS (*U. S. Dept. Agr., Office of Experiment Stations Bul. 54, pp. 20, pl. 1, dgm. 1*).—This is a continuation of work previously reported (E. S. R., 9, p. 264). A detailed study was made of the composition of a side of beef taken from a steer representing as nearly as possible the average animal raised upon New Mexico cattle ranges. A dietary study was also made with one of the families previously studied. The usual methods were followed. The nutrients consumed per man per day were protein 85 gm., fat 71 gm., and carbohydrates 563 gm., with a fuel value of 3,320 calories. The cost was 7.1 cts. The total expenditure for food during 14 days of the dietary study was $2.78. Of this only 21 cts. was expended for food accessories, coffee being the only such article purchased. The waste was estimated to cost but 4 cts. It is noted that the diet falls below the commonly accepted standard in both protein and energy.

Deep stalls and ordinary stalls for steers, together with feeding experiments with molasses peat and molasses bran, F. ALBERT (*Landw. Jahrb., 27 (1898), Nos. 1–2, pp. 174–188*).—General statements are made concerning the animals fed at the experiment farm at Lauchstädt, and a number of feeding experiments are reported. A test, beginning June 29, 1896, and covering two periods of 49 and 66 days, was made with 24 steers, divided into 2 equal lots. One steer was dropped from each lot before the close of the test. The average weight of the steers was 400 to 500 kg. They were purchased at some distance from the station, and lost 44.23 kg. each during transportation. Lot 1 was kept in deep stalls (see p. 574) and lot 2 in ordinary stalls. During the preliminary period of 14 days the steers were fed a ration of hay and

beet chips, with wheat bran in addition, the amount being increased from 2 to 4 kg. per 1,000 kg. live weight.

During the first period both lots were fed a ration consisting of 5 kg. alfalfa hay, 8 kg. straw and hay, 8 kg. dried-beet chips, 8 kg. molasses bran, and 3¼ kg. cotton-seed meal per 1,000 kg. live weight. This was calculated to furnish 3.01 kg. nitrogenous material and 14.97 kg. digestible nitrogen-free material, including fat. The daily average gain of lot 1 was 1.49 kg. and of lot 2, 1.265 kg. The loss of weight during transportation was made good in 37 days.

During the second period the steers were fed a basal ration of 5 kg. alfalfa hay, 8 kg. straw and chaff, 8 kg. dried beet chips, and 3 kg. cotton-seed meal per 1,000 kg. live weight. In addition, 6 animals in lot 1 and 5 in lot 2 were fed 6 kg. of molasses peat and 6 kg. of molasses bran. Five animals in lot 1 and 6 in lot 2 were given 12 kg. of molasses bran. It was calculated that both rations furnished 3.08 kg. digestible nitrogenous material and 17.28 kg. nitrogen-free material.

The variations in weight of each steer are recorded. The steers in deep stalls fed molasses peat made an average daily gain of 0.88 kg. and those fed molasses bran 7.27 kg. Those kept in ordinary stalls fed molasses peat made an average gain of 1.121 kg. and those fed molasses bran of 1.303 kg. The two molasses feeds were about equal. In the first period the deep stalls seemed superior and in the second period the reverse was true.

At the close of the test the steers were sold and slaughtered. The weight of the carcass and organs is recorded for 3 steers. Body measurements were also taken.

The financial statement is based on alfalfa hay at \$1.20, chaff and straw at 48 cts., beet chips at \$1.83, peat molasses at 96 cts., cotton-seed meal at \$2.92, wheat bran at \$2.26, and molasses bran at \$1.51 per 100 kg. The steers were purchased at 15.8 cts. and sold at 16.8 cts. per kilogram. Without taking account of the manure it was calculated that the steers gave a profit of \$177.24. The value of the manure is discussed.

Feeding experiment No. 2 with steers, F. ALBERT (*Landw. Jahrb., 27 (1898), No. 1–2, pp. 203–208*).—In continuation of work reported above, a test was made with 14 steers 2½ to 3 years old fed in deep stalls until they were fit for market. The test began November 6, 1896, and covered 197 days. The first 14 days were regarded as a preliminary period. During this time the steers were fed per 1,000 kg. live weight, 60 kg. fodder beets, 5 kg. alfalfa hay, 3 kg. meadow hay, 8 kg. barley straw, 1 kg. cotton-seed meal, and 2 kg. wheat bran. This was calculated to furnish 1.977 kg. digestible protein and 12.545 kg. digestible nitrogen-free material. During the feeding experiment proper the ration per 1,000 kg. live weight consisted of 60 kg. fodder beets, 5 kg. alfalfa hay, 2.5 kg. meadow hay, 8 kg. barley straw, 3 kg. cotton-seed meal, and 8 kg. molasses bran (molasses and bran 1:1). This furnished 3.123 kg. digestible protein and 17.149 kg. nitrogen-free material. During transportation to the station the steers lost 54.8 kg.

each. This was made good in 47 days. The gains in weight of the different steers are recorded. The daily gain per steer during the test was 0.727 to 0.882 kg.

The financial statement is based on fodder beets at \$1.92, beet chips at \$1.68, alfalfa hay at \$1.20, meadow hay at \$1.20, barley straw at 48 cts., cotton-seed meal at \$2.92, wheat bran at \$2.25, and molasses bran at \$1.51 per 100 kg. The steers were purchased at 16.3 cts. and sold at 17.3 cts. per kilogram. Without taking into account the manure the steers gave a profit of \$177.24.

Fattening lambs in winter, T. SHAW (*Minnesota Sta. Bul. 57, pp. 416–467, figs. 4*).—This is a continuation of previous work of the station (E. S. R., 8, p. 251).

Fattening Minnesota lambs (pp. 417–434).—A test was made with 100 lambs to compare combinations of coarse grains grown in the State and to compare limited and unlimited rations. Five of the lambs were home-grown; the rest were purchased in Minnesota at 3½ and 4 cts. per pound. After the lambs were received at the station they were pastured and given some oats in addition until the beginning of the test. The test, which was preceded by a preliminary period of 7 days, began December 30, 1895, and covered 77 days. The lambs were divided into 5 lots of 20 each. Lot 1 was fed unlimited amounts of linseed cake, corn, and oats 1:3:6. Lot 2 was fed all they would eat up clean of the same ration. Lot 3 was fed a like amount of linseed cake, barley, and oats 1:3:6. The same ration was fed to lot 4 for the first 6 weeks of the experiment, but during the last 5 weeks the proportion of the different feeding stuffs was changed to 2:3:5. During the first 6 weeks of the test lot 5 was fed all they would eat up clean of linseed cake and oats 1:9. In the latter part of the experiment the proportion was changed to 2:8. During the first 6 weeks of the test all the lots were fed native hay which was of poor quality. During the last six weeks of the test, hay of good quality, consisting almost entirely of clover, was fed. The linseed cake was fed in pieces about the size of a pea. The hay was fed whole and the grain was unground. About 21 days were required to get the lambs onto full feed. The financial statement is based on linseed cake at \$14 per ton; corn, 18 cts. per bushel of 56 lbs.; barley, 16 cts. per bushel of 48 lbs.; oats, 14 cts. per bushel of 32 lbs.; and native hay at \$3 and clover hay at \$3.50 per ton. The results of the test are summarized in the following table:

Summary of results of feeding Minnesota lambs.

	Total food consumed.		Average weight at beginning.	Average gain per lamb.	Profit per lot.
	Grain.	Hay.			
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	
Lot 1	3,821	900	96.4	31.6	\$5.90
Lot 2	3,710	1,459	99.6	31.3	11.60
Lot 3	3,645	1,355	96.9	30.2	10.91
Lot 4	3,655	1,361	99.1	31.8	11.74
Lot 5	3,695	1,236	99.2	30.2	9.08

Fattening range lambs (pp. 435–461).—A test was made with 120 Montana range lambs to learn whether such lambs could be profitably fattened under ordinary farm conditions. After a preliminary period of 6 days, the test proper began November 16, 1896, and covered 84 days. The lambs weighed on an average 57.2 lbs. and cost in Montana on an average $1.25 per head. Lot 1 was fed linseed cake, wheat bran, corn, and oats 1:2:3:4; lot 2, oil cake, bran, barley, and oats in the same proportions; lot 3, bran, linseed cake, barley, and oats in the same proportions; lot 4, linseed cake and oats 1:9. All the lambs were given native hay in addition to the grain ration. They were fed in sheds with yards. The financial statement is the same as in the previous statement with the addition of bran at $6.50 per ton. The principal results are shown in the following table:

Summary of results of feeding Montana range lambs.

	Total food consumed.		Average weight at beginning.	Average gain per lamb.	Profit per lot.
	Grain.	Hay.			
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	
Lot 1	5,127	1,208	58.1	19.0	$30.16
Lot 2	4,974	1,200	57.0	18.5	29.37
Lot 3	5,127	1,196	57.0	22.7	32.98
Lot 4	4,771	902	57.2	18.9	28.35

A second test, under practically the same conditions as the preceding experiment, was made with 120 lambs divided into 4 lots of 30 each. The test, which was preceded by a preliminary period of 7 days, began November 8, 1897, and covered 112 days. The lambs weighed on an average 55½ lbs. when purchased. Lot 1 was fed linseed cake, wheat bran, and oats 1:2:3:4; lot 2, linseed cake, bran, barley, and oats in the same proportion; lot 3, bran, oats, and barley 3:3:4; lot 4, oil cake, bran, and oats 1:2:7. In addition, all the lots were fed mixed hay, in which clover predominated, and sorghum silage. The financial statement is based on linseed cake at $22 per ton, wheat bran $7.50 per ton, corn 22 cts. per bushel of 56 lbs., barley 20 cts. per bushel of 48 lbs., oats 17 cts. per bushel of 32 lbs., mixed hay, clover, and timothy $4, and sorghum silage $1.20 per ton. The results are summarized in the following table:

Summary of results of feeding Montana range lambs.

	Total food consumed.			Average weight at beginning.	Average gain per lamb.	Profit per lot.
	Grain.	Hay.	Silage.			
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Lot 1	6,330	2,771	1,024	61.6	35.1	$56.20
Lot 2	6,256	2,773	1,026	61.2	31.8	50.81
Lot 3	6,005	2,735	1,034	61.4	29.1	51.55
Lot 4	6,252	2,655	1,026	60.4	35.7	51.76

The author discusses the tests as a whole and draws the following general conclusions:

"(1) Both range lambs and home-grown lambs are well adapted for feeding.

"(2) The value of the increase made from feeding lambs in our State is more than the cost of the food used in making it.

"(3) The coarse cereals which Minnesota produces are well adapted to the fattening of lambs when suitably blended.

"(4) When lambs are being fattened, considerably superior gains will be obtained when the grain food contains at least 10 per cent of oil cake.

"(5) Oil cake, barley, and oats, suitably blended, with or without bran, makes an excellent grain food for fattening lambs.

"(6) While good gains may be secured by feeding oats and oil cake, suitably blended, the dearness of the mixture makes it too costly to furnish the highest profit.

"(7) Excellent gains can be secured when fattening lambs in our climate in the absence of field roots or silage.

"(8) Under the conditions which have prevailed during the past three years, an average of about $1 per head could be secured from feeding lambs judiciously for about 100 days."

Peanuts, cowpeas, and sweet potatoes as food for pigs, J. F. DUGGAR (*Alabama College Sta. Bul. 93, pp. 115–134*).—*Feeding experiments with peanuts* (pp. 117–121).—Immediately after weaning 6 Poland China pigs were hurdled on a field of Spanish peanuts and given some shelled corn in addition. The test began in September and covered 6 weeks. The peanuts were eaten readily from the first and as long as the vines remained green a considerable portion of the leaves was also eaten. The yield of peanuts was 62.6 bu. per acre. The 6 pigs weighed at the beginning of the test 184.3 lbs., and gained 196.4 lbs., consuming 373 lbs. of shelled corn, besides the peanuts and some foliage from 7,673 sq. feet. That is, 1.4 lbs. of peanuts and 1.9 lbs. of corn, together with an unknown quantity of peanut foliage, were consumed per pound of gain. Valuing the corn at 40 cts. per bushel and the pork at 3 cts. per pound, the profit from the peanuts was $3.23 or at the rate of $18.34 per acre. The author points out that this was poor sandy upland which would not have produced over 200 lbs. of lint cotton per acre worth $10 to $12. The expense of cultivating the peanuts was less than for a similar area of cotton and in addition the soil was benefited by the manure and the peanut vines.

To compare peanut pasturage and corn meal a second test was made with 6 Essex pigs of about the same age, divided into 2 lots. Lot 1 was hurdled on peanuts which were planted the last of June following wheat, and given as much corn in addition as the pigs would eat. Lot 2 was hurdled on peanuts but given no grain. After a preliminary period of a week the test began November 4 and continued 4 weeks. Lot 1 grazed over 2,025 sq. ft. of peanuts and gained 38.6 lbs., consuming 2.06 lbs. of corn per pound of gain in addition to the peanut forage. Valuing the corn and pork at the prices given above, the peanuts yielded a profit of $10.94 cts. per acre. Lot 2 grazed over

3,517 sq. ft. of peanuts, making a gain of 21.1 lbs. This was equivalent to a profit of $7.83 per acre. In the author's opinion, owing to an exceedingly dry summer, the yield of peanuts was only about half what it would have been under usual conditions. He believes that pigs under 100 lbs. weight would make pork worth from $12 to $20 on an acre of peanuts, provided they were fed a moderate allowance of corn or corn meal in addition.

In the third test unhulled peanuts and corn meal were compared. For 6 weeks the 2 lots of pigs used in the previous test and a third lot of the same age and breed were fed the following rations: Lot 1 unhulled peanuts and corn meal, equal parts; lot 2 peanuts alone, and lot 3 corn meal. The gains made by the 3 lots were 84, 59.5, and 8.6 lbs., respectively. The food consumed per pound of gain by the corresponding lots was 3.7, 2.8, and 10.7 lbs. The author calculates that when fed peanuts alone the young pigs were able to make a growth of 9 lbs. per bushel of peanuts, equivalent to a profit of 27 cts. per bushel. Although the addition of corn to the peanut ration increased the gains, they were produced at a greater cost. The pigs fed exclusively on corn gave very poor returns. In the author's opinion this test shows the bad effects of long-continued feeding of corn alone.

Feeding experiments with cowpeas (pp. 122–125).—Six Essex pigs of the same litter were divided into 2 lots of 3 each. Lot 1 was fed shelled corn *ad libitum*, and lot 2 was hurdled on a field of cowpeas and given corn in addition. The test covered 6 weeks and was preceded by a preliminary period of 7 days. At the beginning of the test the leaves of the cowpeas were all green and only about half the peas seemed mature, although the others had attained full size. While the leaves remained green they were readily eaten. In the latter half of the experiment only the peas were eaten. Both lots of pigs received salt and wood ashes. The lots averaged about 150 lbs. at the beginning of the test. Lot 1 gained 45.2 lbs., consuming 263.8 lbs. of corn, or 5.86 lbs. per pound of gain; and lot 2 gained 122 lbs., consuming 374 lbs. of corn, or 3.07 lbs. per pound of gain. Lot 1 grazed over 7,280 sq. ft. On the basis of the yield from a similar field, this area would have produced 132 lbs. of cowpeas. In other words, 1.1 lbs. of cowpeas were consumed per pound of gain in addition to corn, or a total of 4.17 lbs. of corn and cowpeas. It was calculated that the cowpeas would return $10.65 per acre in pork. This, in the author's opinion, is not a large return, but it should be borne in mind that the land was enriched by the cowpea vines and by the manure from the pigs.

To compare the value of ground cowpeas and corn with ground corn alone a further test was made with the same pigs. Lot 1 was continued on an exclusive corn ration and lot 2 was fed ground corn and ground cowpeas 1 : 1. The test covered 70 days and was preceded by a preliminary period of 7 days. Lot 1 gained 68 lbs., consuming 548.2 lbs. of corn, or 8.06 lbs. per pound of gain. Lot 2 gained 108 lbs., consuming

569.9 lbs. of corn meal and ground cowpeas, or 5.28 lbs. of the mixture per pound of gain. The nutritive ratio of the ration fed to lot 1 was 1: 9. 7 and of lot 2, 1: 6.2.

It was planned to duplicate this test, comparing cowpea pasture with corn meal with 2 Essex sows with litters of 6 and 7 pigs, respectively. The test was discontinued after 3 weeks owing to the death of one of the sows. During this time the sow and 6 pigs fed corn in addition to cowpea pasturage gained 29.9 lbs., while the sow and 7 pigs fed corn alone lost 9 lbs.

Sweet potatoes vs. corn meal (pp. 126–129).—The 6 Poland-China pigs used in the first test recorded above were divided into 2 equal lots weighing 191.5 lbs. and 189.2 lbs., respectively. After a preliminary period of 1 week the test began November 4 and covered 2 periods of 28 days each. During the first period lot 1 was fed sweet potatoes and ground peas, 3: 1, and lot 2 was fed corn meal and cowpeas 1: 1. Both lots were given all they would eat. Owing to the different character of the rations it was not found possible to give them the same amount of dry matter. During the second period the rations were reversed. During the whole test the pigs fed sweet potatoes and cowpeas gained 65.8 lbs., consuming 877.7 lbs. of food, or 13.34 lbs. (equivalent to 6 lbs. dry matter) per pound of gain. The pigs fed corn meal and cowpeas gained 130.2 lbs., consuming 520.8 lbs. of food, or 4 lbs. (equivalent to 3.6 lbs. dry matter) per pound of gain. The author attributes the poor gains made on sweet potatoes to the fact that the pigs could not eat a sufficient amount of the bulky ration, and believes that more favorable returns would have been obtained with a ration of equal parts of sweet potatoes and cowpeas. It was calculated that the sweet potatoes returned only 13 cts. per bushel.

"This does not imply that sweet potatoes can not be profitably employed as food for hogs; but a profit is possible only by saving the expense of harvesting, the heaviest single item of expense in sweet-potato culture. If the hogs do the rooting, the sweet potato is doubtless a cheaper food than corn on some sandy soils that yield 10 to 15 times as many bushels of sweet potatoes as of corn. The vines are also valuable as food for hogs.

"The value of sweet potatoes will be enhanced by feeding with them a liberal allowance of cowpeas or peanuts, which supply the nitrogenous material in which the sweet potato is deficient."

The pigs used in the various tests were slaughtered and the total dressed weight was recorded, as well as the ratio of the lungs, heart, liver, spleen, kidneys, etc., to the total weight.

The author discusses the effect of cowpeas and peanuts on the quality of pork. The average melting point of leaf and body lard from pigs fed corn meal and cowpeas was 45.3° C.; from pigs fed corn alone, 43.7°; from pigs fed peanuts and corn, 40.5°, and from pigs fed peanuts alone, 24.5°.

The author remarks that it is a common practice among farmers when pigs have been fed peanuts, sweet potatoes, and acorns to give them

corn alone for several weeks before slaughtering. This is done to harden the meat. With the view of obtaining information on this point, 1 pig each from the lots fed cowpeas and corn meal, peanuts alone, and peanuts and corn meal was fed corn only for a month before slaughtering. The melting point of the lard from the 3 pigs was 43°, 38.5°, and 37°, respectively. Cooking tests were made of the pork from the different pigs.

"Cowpeas fed with corn did not injuriously affect the quality of pork or lard. Peanuts when fed with corn greatly softened the pork and lard. The softening effect of peanuts was still greater when they constituted the sole food. This softening effect of peanuts was not corrected by feeding exclusively on corn for a month before the date of slaughtering. . . . Lard from exclusive peanut feeding solidified only during the coldest weather of February, at other times in February and March becoming almost a semiliquid. The low melting point or want of firmness of lard made from peanuts injures its sale. However, cooking tests fail to reveal any real inferiority."

Some experiments with poultry, C. D. Smith, C. S. Brooks (*Michigan Sta. Bul. 158, pp. 329-341*).—The authors describe the station poultry house, discuss several trials with incubators, and report a number of feeding experiments with poultry. The chemical composition of eggs of different breeds and under different conditions of feeding is also given.

Coarsely cracked vs. finely ground grain for young chickens.—Eighty-six Barred Plymouth Rocks and 14 Golden Wyandotte chickens were divided into 2 equal lots 10 days after hatching. Lot 1 was fed coarsely cracked corn from which the meal was sifted and an equal weight of clean wheat screenings; lot 2 was fed corn and wheat in the same proportions, the grains being ground to a coarse flour. In addition both lots were given enough sweet skim milk to thoroughly moisten the grain, and the same amounts of oyster shells, finely cut green bone, lettuce, and cabbage.

At the beginning of the test, which lasted 7 weeks, lot 1 weighed 5.7 lbs. and lot 2 5.8 lbs. During the test 7 chickens in lot 1 and 6 in lot 2 died. At the close of the test lot 1 weighed 49.8 lbs. and had eaten 39.25 lbs. of wheat screenings and the same quantity of corn. Lot 2 weighed 59.5 lbs. and had consumed a pound more of each of the grains than lot 1. The conclusion is reached that there was a slight advantage in grinding the grain for young chickens.

Immediately after the close of this test a comparison of wheat and cracked corn was made with the same lots. The test was divided into 2 periods of 6 weeks each. Lot 1 was given whole wheat and lot 2 coarsely cracked corn, each lot being fed the same amounts of lettuce, cabbage, rhubarb, oyster shells, and green bone. In the first period lot 1 gained 51.7 lbs., consuming 2.8 lbs. of wheat per pound of gain. Lot 2 gained 117 lbs., consuming 2.77 lbs. of corn per pound of gain. During the second period lot 1 gained 72.5 lbs., consuming 2.62 lbs. of wheat per pound of gain, while lot 2 gained 83 lbs., consuming 2.5 lbs.

of corn per pound of gain. The amounts of lettuce, green bone, etc., consumed are recorded and were quite considerable.

In the author's opinion there was no great difference in the feeding value of the wheat and corn. "The gains made were satisfactory and again point to the advantage, if not the necessity, of variety in the ration of growing fowls."

The feeding of the 2 lots was continued to see if more food was required for a pound of gain as the chickens grew heavier. Both lots were fed oyster shells, green bone, sunflower seed, and turnip tops in addition to the grains. In 3 weeks lot 1 gained 21.8 lbs., consuming 6.56 lbs. of grain per pound of gain. Lot 2 gained 23.5, consuming 5.8 lbs. of corn per pound of gain. "These figures are significant and go far to show that one of the most common mistakes in poultry fattening is holding the chickens too long in the fall."

Relative gains of young ducks and chickens.—A lot of 39 ducks 2 weeks old at the beginning of the test was compared with an equal number of chickens of the same age in order to learn which could be more profitably fattened. The ducks were given middlings, corn meal, and bran, together with necessary grit and green food. They had the run of a small yard. The chickens were fed bran and relatively more corn meal than the ducks, but had no middlings. They were allowed the run of a small grass plat and were also given lettuce. At the beginning of the test the ducks weighed 13.25 lbs. and the chickens 7.5 lbs. In 5 weeks the ducks were nearly ready for the early market and had gained 108.75 lbs. They had eaten 41.3 lbs. of corn, 93.1 lbs. of middlings, 43.4 lbs. of bran, 59 lbs. of lettuce, and 88 lbs. of skim milk. The total cost of a pound of gain was 1.9 cts. In the same period the chickens had gained 30 lbs. and had consumed 52.2 lbs. of corn, 25.9 lbs. of bran, 46 lbs. of lettuce, and 44.3 lbs. of skim milk. The total cost of a pound of gain was 4.84 cts. The financial statement is based on corn and bran at $14, and middlings at $15 per ton, milk at 20 cents per hundred, and lettuce at 1 cent per pound. The ducks gained much more rapidly than the chickens and the gains were more economically made. The chickens were not large enough for market at the close of the test and the feeding was continued for some time before they were sold. The gains made and the cost of gain are briefly reported.

Feeding laying hens.—Three lots of hens, each made up of 4 Minorcas, 4 White Plymouth Rocks, 9 Barred Plymouth Rocks, 5 Light Brahmas, 8 grade Plymouth Rocks, and 5 crossbred Buff Wyandotte-Light Brahmas, were fed 6 months under the same conditions. Lot 1 laid 2,228 eggs; lot 2, 2,362, and lot 3, 2,288.

"While this difference is not large, had a change in condition, whether of feeding or some other item involved in the care been made between these pens, the difference would have been large enough to be considered somewhat significant. The fact that it occurred when all known conditions were alike teaches again the danger of drawing conclusions from the results of one experiment."

A comparison was also made with Golden Wyandottes, Single-Comb Brown Leghorns, and Barred Plymouth Rocks. The 3 lots received the same care and same rations. They were given a mixed diet containing as great a variety of food as possible, consisting of corn, oats, bran, wheat, and linseed meal. The test covered a year.

"The Wyandottes laid in the year 3,555 eggs, weighing 451.8 lbs.; the Leghorns laid 3,225 eggs, weighing 322.5 lbs., and the Plymouth Rocks 3,360, weighing 419.2 lbs. The hens were fed alike and consumed approximately the same quantity of food. The . . . record shows a marked difference of breeds in the number of eggs laid."

Winter feeding of capons.—A test to see whether feeding could be profitably carried on in winter was begun September 1 with 50 capons of a number of different breeds. During the test, which closed March 1, 9 capons died. The total food consumed was as follows: 743 lbs. corn, 236 lbs. table scraps, 120 lbs. wheat, 74 lbs. bran, 80 lbs. oats. The capons were worth at the beginning of the trial $10.20; their average weight was 2.55 lbs. At the close of the test the average weight was 8.2 lbs. Rating corn at 70 cts., wheat at 65 cts., bran at 70 cts., and oats at 20 cts. per bushel, and table scraps at 2 cts. a pound, the total profit of feeding the capons was calculated to be $5.22.

Chemical composition of eggs.—The chemical composition of eggs of a number of breeds was determined by L. A. Chittenden and reported by the authors. The eggs laid by the different breeds were found to have approximately the same composition. The effect of the character of the rations on the composition of eggs was also tested with two lots of Barred Plymouth Rocks, Wyandottes, and Brown Leghorn chickens. The test covered 6 weeks. Lot 1 was fed meat scraps, wheat, and linseed meal, 1:8:1. Lot 2 was fed corn, tallow, and rice meal, 7:1:2. Both lots were given lettuce and oyster shells in abundance. The composition of the eggs is reported in detail. No marked variation in the composition of the eggs due to different rations was observed, but the test is not regarded as conclusive, since it was of short duration.

On the composition and food value of native beans, BALLAND (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 15, pp. 532–534*).—The maximum and minimum composition of French beans is reported.

Complete bread, A. CELLI (*Salute Pub., 11 (1898), No. 1, pp. 1–5*).—A comparison of ordinary bread with that made by the "antispire" system.

The bread question, U. MILONE (*Reforma Chim., 1 (1897), pp. 419–429*).—A discussion of the "antispire" system bread.

Wheat bread, TISON (*Jour. Hyg., 23 (1898), No. 1157, pp. 561–563*).

Utilization of by-products of the dairy, H. E. ALVORD (*U. S. Dept. Agr. Yearbook 1897, pp. 509–528*).—The food value of skim milk, whey, and buttermilk is discussed. In addition to the value of these materials as food for animals, attention is called to their use for a number of manufactured products. The value of skim milk as a fertilizer is also noted.

The needs and requirements of a control of feeding stuffs, E. W. ALLEN (*U. S. Dept. Agr. Yearbook 1897, pp. 421–428*).—The variation in composition of concentrated feeding stuffs owing to changes in manufacture or adulteration is pointed out and

the need of State control similar to that of fertilizers is insisted upon. It is noted that in many cases inferior goods are sold under names which are delusive. So-called condimental feeding stuffs are also discussed. As shown by analysis, these materials have comparatively little feeding value as compared with their price. The medicinal substances which they contain are of doubtful value and, as shown by tests, they do not produce the improvement which is claimed for them.

Composition and nutritive value of millet, BALLAND (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 4, pp. 239, 240*).—The maximum and minimum composition of African, French, Italian, and Turkish millet is reported.

On the quality of the so-called molasses feed, now found on the market, M. WEIBULL (*Tidskr. Landtmän, 19 (1898), No. 24, pp. 423–426*).—Ten samples of different origin were examined and analyzed, and only three samples were found of standard quality, made up of beet molasses, wheat bran, and palm-nut meal, in the proportions of 50:40:10.

Investigation of the milling products of rye which are used as feeding stuffs, B. SCHULZE (*Ztschr. Landw. Kammer Schlesien, 1898; abs. in Centbl. Agr. Chem., 27 (1898), No. 11, pp. 746–751*).—A report of the examination of a large number of samples of rye bran, etc. The various causes which injure such feeding stuffs are pointed out.

Nutritive value of mushrooms, MARY H. ABEL (*Amer. Kitchen Mag., 9 (1898), No. 4, pp. 127, 128*).—A general discussion of the subject. The author calls attention to the fact that the actual amount of nutriment in mushrooms is small.

Chicory: Its manufacture, sophistication, and adulteration, A. RUFFIN (*Bul. Assoc. Chim. Sucr. et Distill., France, 16 (1898), No. 1, p. 107*).—A note on a paper presented before the Société Chimique du Nord de la France, and also the Société industrielle du Nord de la France.

Preservation of eggs (*Jour. Soc. Arts, 46 (1898), No. 2363, p. 370; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 3, pp. 261, 262*).—A brief account of experiments previously noted from another source (E. S. R., 9, p. 981).

Foods, A. P. BRUBAKER (*Sci. Amer. Sup., 46 (1898), No. 1196, pp. 19179–19182*).—A lecture delivered at the Drexel Institute, Philadelphia, and revised by the author for publication.

Food and feeding, SIR H. THOMPSON (*London: F. Warne & Co., 1898, 9 ed. rev. and enl., pp. 312*).

The feeding of farm animals (*Rpt. Agr. New Brunswick, 1897, pp. 183–208*).—This is a reprint of U. S. Dept. Agr., Farmers' Bulletin 22.

The principles of stock feeding, W. J. SPILLMAN (*Washington Sta. Bul. 29, pp. 31*).—A general treatise on the subject. Among the points covered are the composition of the animal body, uses of foods, constituents of feeding stuffs and the functions of each, compounding rations, feeding standards, and rearing calves. The amount of digestible nutrients in a number of feeding stuffs are shown and a number of feeding standards for various farm animals are quoted. Some of the points are discussed with special reference to conditions prevailing in the State.

Contributions to the comparative physiology of digestion. II, An enzym in the liver secretion of Helix pomatice which dissolves cellulose, W. BIEDERMANN and P. MORITZ (*Arch. Physiol. [Pflüger], 73 (1898), No. 5–6, pp. 219–287*).

Increase in body weight by transformation of fat into glycogen, C. BOUCHARD (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 14, pp. 464–469*).—Experiments are reported in which a rabbit, a mouse, and dogs were fed fat. The conclusion was reached that under certain conditions sugar can be formed from fat.

Observations on the supposed transformation of fat into glycogen, M. BERTHELOT (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 15, pp. 491–496*).—A discussion of the question of the formation of sugar from fat proposed by C. Bouchard. (See above.)

History of cattle and their rôle in civilization, CHESTER (*Histoire et rôle du bœuf dans la civilization. Paris: Schleicher Frères, 1898*).—This is a volume of *Livres d'Or de la Science; rev. in Jour. Hyg. 23 (1898), No. 1154, pp. 517–521.*

Studies of Bos (brachyceros) europæus, the wild form from which the domestic cattle of Europe are descended, L. ADAMETZ (*Jour. Landw., 46 (1898), No. 3, pp. 269–320, pls. 2*).

Some deductions drawn from the weight of slaughtered cattle, P. FALK (*Ztschr. Fleisch u. Milchhyg., 8 (1898), No. 10, pp. 183–187*).—The weight of the contents of the intestinal tract and of the blood and organs is reported in a number of cases.

Pork production, F. D COBURN (*Kansas State Bd. Agr. Quart. Rpt. 1898, Sept., pp. 227, figs. 39*).—Raising pigs in Kansas is discussed at considerable length. Many papers on raising pigs, pig feeding, diseases of pigs, and other general topics are quoted.

Eggs and poultry (*Rpt. Com. Agr. and Dairying Canada, 1897, pt. 8, pp. 33, figs. 12*).—Among other topics the number of eggs imported into Great Britain, the prices received, preservation of eggs, packing eggs, the value of poultry imported by Great Britain, and fattening of turkeys are discussed. Articles on eggs in winter and choice poultry, by A. G. Gilbert, are quoted.

Determining the age of poultry and game, W. NIEBEL (*Ztschr. Fleisch u. Milchhyg., 9 (1898), No. 2, pp. 21–27, figs. 7*).—The methods discussed include difference in the wing feathers, spurs, etc., of birds of different ages.

A manual of hygiene and sanitation, S. EGBERT (*Philadelphia & New York: Lea Bros. & Co., 1898; rev. in Amer. Kitchen Mag., 10 (1898), No. 3, p. 112*).

Abstract of a description of a respiration calorimeter furnished by Professors Atwater and Rosa, C. F. LANGWORTHY (*Jour. Amer. Chem. Soc., 20 (1898), No. 9, pp. 681–687*).—A brief description of this apparatus (E. S. R., 9, p. 863), with the results of a number of tests of its accuracy.

Dairy and food commission, J. E. BLACKBURN (*Ohio State Dairy and Food Com. Bul. 3, pp. 13*).—In addition to brief statements concerning adulterated butter, poisonous butter color, new vinegar law, and oleomargarine, and certain drugs and medicines, the bulletin contains an account of the proceedings instituted in Ohio against the manufacture of a well-known proprietary medicine. Brief statements are also made concerning samples procured in a number of cities for inspection.

Twelfth Annual Report of the Ohio Dairy and Food Commissioner (*Ohio State Dairy and Food Com. Rpt. 1898, pp. 232*).—Statements are made concerning the samples of oleomargarine, whisky, sugar, patent medicines, tea, baking powder, tainted meats, flavoring extracts, flour, candy, cheese, and vinegar examined, and court decisions are quoted. The report of the State Dairy and Food Commission chemists on a number of foods and drugs analyzed is given in detail, cases of the violation of law prosecuted are cited, and the expenditures in prosecuting the same.

DAIRY FARMING—DAIRYING.

Feeding experiments with cows at the experiment farm at Lauchstädt, F. ALBERT and M. MAERCKER (*Landw. Jahrb., 27 (1898), No. 1–2, pp. 188–203*).—The object of this experiment was to study the effect on milk production of increasing the fat in the ration. Ten new milch cows were used, 5 Simmenthaler and 5 Altmärker. The experiment began early in February and lasted until the middle of June. The plan was to feed all of the cows alike, giving a constant basal ration of sugar beets, hay, and straw. To this was added in the preparatory period rape-seed cake, cotton-seed meal, and wheat bran, giving a total of 3 kg. of protein per 1,000 kg. live weight. The fat

content of the coarse fodder was left out of account, as this was constant in all the periods. It was 0.5 kg. in the preparatory period. In subsequent periods palm-nut cake and two kinds of cocoanut cake were substituted for a portion of the grain ration, so as to maintain the protein content exactly the same as in the preparatory period, and to increase the fat content of the ration up to 1.706 kg. per 1,000 kg. live weight. In the second and the last periods disembittered lupine was fed with the basal ration of coarse fodder and wheat bran, giving a ration relatively poor in fat. The changes from one ration to another were made gradually and were not accompanied by any apparent disturbance of the cows.

A summary of the average results with each cow is given in the following table:

Effect on milk of feeding rations rich and poor in fat.

Cow No.	Preparatory periods.						Ration rich in fat, I.			Ration poor in fat.		
	Averages from Feb. 10-12.			Normal ration; 0.504 kg. fat. Averages from Feb. 15-21.			Palm-nut cake; 0.937 kg. fat. Av. March 1-7.			Disembittered lupine; 0.297 kg. fat. Av. March 20-30.		
	Milk yield.	Fat content.	Fat yield.	Milk yield.	Fat content.	Fat yield.	Milk yield.	Fat content.	Fat yield.	Milk yield.	Fat content.	Fat yield.
	Kg.	*Per ct.*	*Gm.*	*Kg.*	*Per ct.*	*Gm.*	*Kg.*	*Per ct.*	*Gm.*	*Kg.*	*Per ct.*	*Gm.*
655	13.9	2.83	394.97	13.87	3.26	452.4	13.42	3.67	492.7	14.01	3.33	465.87
802	......	Dry.	......	......	Dry.	......	16.33	3.69	602.9	15.72	3.24	509.93
1952	11.43	2.55	292.7	9.75	3.18	309.97	10.9	3.28	356.9	10.61	2.92	309.80
1953	6.33	3.04	192.8	6.43	3.25	208.8	5.82	3.73	216.7	6.03	3.70	323.10
3579	14.1	3.64	513.2	14.7	3.77	554.6	14.6	4.29	627.5	13.24	4.17	551.60
1	19.6	3.15	617.8	19.4	3.44	667.7	20.1	3.02	607.1	18.40	2.87	529.00
2	27.7	3.17	877.9	26.0	3.22	838.3	21.5	3.96	871.5	18.04	3.07	554.60
3	16.6	2.79	463.1	17.7	2.77	491.5	18.8	2.68	503.5	16.20	2.66	430.60
4	24.2	2.87	695.4	23.0	2.93	674.7	20.4	3.87	789.6	22.18	2.84	630.83
5	21.0	3.12	654.4	20.3	3.26	662.3	21.3	3.14	670.4	19.20	3.20	615.30
Average	17.2	3.03	522.5	16.8	3.21	540.0	16.32	3.52	573.88	15.36	3.20	492.06

Cow No.	Ration rich in fat, II.			Ration rich in fat, III.			Ration poor in fat.		
	Cocoanut cake; 0.747 kg. fat. Av. April 16-28.			Cocoanut cake; 1.706 kg. fat. Av. Apr. 30-May 14.			Disembittered lupine; 0.297 kg. fat. Av. May 22-29.		
	Milk yield.	Fat content.	Fat yield.	Milk yield.	Fat content.	Fat content.	Milk yield.	Fat content.	Fat yield.
	Kg.	*Per cent.*	*Gm.*	*Kg.*	*Per cent.*	*Gm.*	*Kg.*	*Per cent.*	*Gm.*
655	15.02	3.628	544.9	13.9	4.42	613.2	14.7	3.23	473.3
802	16.00	3.297	527.3	12.3	3.70	468.4	14.0	2.92	408.2
1952	10.34	3.282	339.57	9.5	3.99	378.5	10.7	3.23	346.1
1953	5.99	3.901	233.73	4.9	4.47	220.0	5.5	3.87	214.0
3579	12.50	4.290	536.25	11.6	4.60	536.1	12.5	4.25	529.5
1	16.58	3.311	549.07	14.7	3.84	565.4	14.7	2.95	433.7
2	15.17	3.571	541.7	12.5	3.99	497.5	13.1	2.93	383.1
3	15.38	3.197	491.7	12.6	3.43	433.0	14.1	2.79	393.6
4	22.57	3.144	709.8	18.5	3.55	658.3	20.5	2.79	573.4
5	16.95	3.650	618.9	13.7	4.00	548.9	14.4	3.30	473.8
Average	14.65	3.48	509.29	12.42	3.96	491.93	13.42	3.15	422.87

Cows 655 to 3579 were of the Simmenthaler breed and 1 to 5 of the Altmärker.

The authors conclude that a one-sided increase of the fat content of the ration up to 1 kg. of fat per 1,000 kg. live weight had no influence

on the yield of milk, but that with a ration of 1.706 kg. of fat per 1,000 kg. live weight there was a marked decrease in the milk yield.

The effect of palm-nut cake and cocoanut cake in increasing the fat content of the milk the author regards as beyond question. As compared with the normal ration fed in the preparatory period, there was an increase in the fat content of the milk of 0.31 per cent with palm-nut cake, 0.28 per cent on the first cocoanut-cake ration, and 0.75 per cent on the second cocoanut-cake ration which was unusually rich in fat.

In regard to the total yield of butter fat, the conclusion is reached that "the increase of the fat content of the milk which can be brought about at will by feeding rations rich in fat is almost without effect on the total amount of fat, and may result in a financial loss. . . The use of large amounts of expensive feeding stuffs rich in fat should be avoided, since the possibility of a one-sided increase of the fat content of the milk may lead to a positive loss."

A consideration of the fluctuations in live weight shows that the 1 lb. of fat eaten daily by the cows on the ration richest in fat was not lost but was used for the production of body fat. The Simmenthaler cows were more sensitive to the fat in the ration than the others, as shown by the fact that they decreased 10 kg. per head in weight when palm-nut cake was replaced by disembittered lupine, while the Altmärker lost only 4 kg. In the first cocoanut-cake period the Simmenthaler gained 13.5 kg. and the Altmärker 11.1 kg. each; and during the second cocoanut-cake period, on the ration richest in fat, the Simmenthaler gained 19.4 kg. and the Altmärker 23 kg. each. The feeding left the Simmenthaler cows overfat and unfit for anything except butchering. The author believes the results suggest a possible means for rapidly fattening dry cows.

Experiments on the question whether in feeding sesame cake there is a transmission of material to the butter which gives the Baudouin reaction, H. WEIGMANN (*Milch Ztg., 27 (1898), No. 34, pp. 529–532*).—[This much discussed question arises out of the regulation of the German oleomargarine law, passed in 1897, which requires the addition of sesame oil to all oleomargarine, as a means of identifying it. This is spoken of as the "latent coloring" of margarine; and the finding of the sesame-oil reaction in butter is taken as evidence that it has been adulterated with margarine.]

An experiment was made with several cows in which a part of the grain ration of some of the cows was replaced by 3 kg. per head of sesame cake, an amount said to be three times as great as is commonly fed in practice. The milk from the sesame-cake feeding was creamed and churned separately and the butter tested for the characteristic rose color with furfurol and hydrochloric acid. None of the samples of butter from the sesame-cake feeding gave a reaction immediately on mixing with hydrochloric acid and furfurol, and therefore it is considered that none of the samples of butter gave the sesame-oil reaction. These samples and also samples of butter produced without sesame-cake

feeding gave the reaction after a time (about 30 minutes) under certain conditions of temperature, strength of reagents, etc. This delayed reaction is believed to be due to a decomposition of the furfurol, as the reaction appeared sooner when large quantities of furfurol were present and when the butter was heated with the reagent. This was also borne out by experiments made with hydrochloric acid alone.

These facts in regard to the reaction explain, the author believes, the finding of sesame-oil reaction in butter by other investigators when sesame cake was fed. Providing the reaction is made according to the prescribed method of the Imperial Health Office, the experiments indicate that no reaction due to the sesame-cake feeding will be found.

The sesame-oil reaction in natural butter, VIETH (*Milch Ztg., 27 (1898), No. 36, pp. 563, 564*).—The author cites a number of instances, among others, some in his own laboratory, in which natural butter from cows which had been fed sesame cake gave the sesame-oil reaction. He considers, for this reason, that the determination of the adulteration of butter with margarin by the "latent coloring" of the latter with sesame oil can not be regarded as an easy and reliable means.

Experiments on the effect on milk production of feeding sugar beets and dried and ensiled diffusion residue, O. KELLNER and G. ANDRÄ (*Landw. Vers. Stat., 49 (1898), No. 6, pp. 402–418*).—This experiment was made with 24 cows on a private estate, but was under the immediate supervision of the Möckern Station. The time of the experiment was divided into 4 periods of 20 days each, the first 8 days of each period being regarded as preparatory. The cows were all fed alike, receiving the same basal ration throughout and practically the same amounts of digestible nutrients in the different periods. The basal ration consisted of hay, straw, linseed meal, cotton-seed meal, peanut meal, and wheat bran, to which was added, per 1,000 kg. live weight, 50 kg. of sugar beets in the first and fourth periods, 8 kg. of dried diffusion residue from a sugar-beet factory in the second period, and 76 kg. of ensiled diffusion residue in the third period. The silo used was merely a hole in the ground, not walled up or plastered; the loss was 33 per cent in weight.

The cows were milked three times daily and the weight of milk, specific gravity, and fat content (the latter by the Gerber method) were determined. The total solids were calculated by Fleischmann's formula. The results are given below:

Results of feeding sugar beets and diffusion residue to cows.

Period.		Average milk yield per day.	Total solids.	Fat content.
		Kg.	*Per cent.*	*Per cent.*
1	Sugar beets	13.755	12.87	3.51
2	Dried diffusion residue	14.101	12.88	3.60
3	Ensiled diffusion residue	14.348	12.72	3.45
4	Sugar beets	12.107	12.92	3.45

The tables of composition do not indicate that the different rations had any noticeable effect on the composition of the milk. The conclusion is reached that both the dried and the ensiled diffusion residue were more favorable to milk production than sugar beets. Making allowance for the natural shrinkage in the yield, on the basis of the first and fourth periods, it is stated that as a result of the substitution of 4.4 kg. of dried diffusion residue in place of 27.5 kg. of sugar beets the milk yield increased 0.953 kg., and of substituting 41.8 kg. of ensiled diffusion residue for the above amount of beets it increased 1.721 kg. per cow (of 550 kg. live weight) without any particular change in the quality of the milk. In the second and third periods when diffusion residue was fed there was in general an increase in the live weight as compared with the first and fourth.

Experiments on the effect on milk production of some new feeding stuffs, with special reference to the fat content, E. Ramm and W. Mintrop (*Milch Ztg., 27 (1898), No. 33, pp. 513–519*).—The object of this experiment was not only to compare certain new feeding stuffs, as cocoa-molasses, molasses-distillery-refuse, blood-molasses, and corn bran, but also to study the effect on the yield and composition of milk of rations furnishing different amounts of fat and protein. The cocoa-molasses was prepared by mixing hot molasses with finely ground cocoa shells. The molasses-distillery-refuse was the residue from the manufacture of alcohol from beet molasses. The blood-molasses was a mixture of blood, molasses, and refuse of cereals.

The experiment began November 5, 1897, and closed May 8, 1898, the time being divided into 10 periods of unequal duration, and the last 5 days of each period being considered. Five cows were used, but owing to the condition of the cows, as subsequently developed, 2 had to be discarded in making up the averages. A basal ration of hay, cut straw, and sugar beets was fed throughout. The rations fed per 1,000 kg. live weight and the yield and fat content of the milk are shown in the following table:

Effect of different rations on milk production.

Period.	Food in addition to basal ration, per 1,000 kg. live weight.	Digestible nutrients in food.			Average daily yield of milk per cow.	Average fat content of milk.	Average yield of fat per 1,000 kg. live weight.
		Protein.	Fat.	Nitrogen-free extract.			
		Kg.	*Kg.*	*Kg.*	*Kg.*	*Per ct.*	*Kg.*
1	12 kg. malt sprouts	2.266	0.427	14.539	15.317	2.957	0.8176
2	12 kg. cocoa-molasses	1.414	.637	13.723	10.244	3.873	.6993
3	8 kg. cocoa-molasses and 3 kg. peanut cake	2.486	.719	13.068	12.748	3.437	.7809
4	8 kg. linseed cake	5.557	1.126	11.861	12.979	2.990	.7036
5	8 kg. malt sprouts and 3 kg. linseed cake	2.443	.693	13.710	12.805	2.880	.6652
6	8 kg. malt sprouts, 3 kg. linseed cake, and 2 kg. molasses-distillery-refuse	2.603	.706	14.104	11.828	2.790	.5929
7	12 kg. corn bran	2.012	.658	15.260	12.162	2.327	.5013
8	8 kg. corn bran and 3 kg. linseed cake	2.275	.847	14.808	12.262	2.74	.5979
9	8 kg. corn bran and 7 kg. blood-molasses	2.121	.608	16.451	13.089	2.990	.6939
10	12 kg. malt sprouts	2.266	.427	14.554	10.546	3.110	.5824

The yield of milk fell off one-third in the second period on cocoa-molasses, believed to be due to the deficiency in protein. The addition of peanut cake in the following period resulted in an increase in yield. The corn bran had a favorable effect on the yield. The fat content of the milk showed wide fluctuations in different periods. Molasses is believed to have had a favorable effect on the fat content wherever it was fed, while the corn bran tended to reduce the fat content. As to the effect of the rations rich in fat, it is believed that there was no apparent relation between the high fat content of the ration and the fat content of the milk. On the two rations rich in fat (periods 4 and 8) the fat content of the milk was below the average, while on the ration poorest in fat (periods 1 and 10) the fat content was above the average. The rations containing corn bran gave the largest production of solids-not-fat. The malt sprouts and linseed cake gave an increase in live weight when they were fed alone or when fed in combination with other feeds. There was a small decrease in live weight on the molasses rations.

In conclusion, the authors state that in agreement with previous results a high fat content of a ration by no means resulted in the production of milk of a high fat content. It is believed, therefore, that little attention need to be paid to the fat content of the ration beyond providing a certain minimum amount—i. e., 0.4 to 0.7 kg. per 1,000 kg. live weight, and that the nitrogen-free nutrients required in excess of this can be more cheaply supplied in the form of carbohydrates.

The different feeding stuffs are considered to have brought about unusually large differences in the percentage of fat in the milk. Excluding the second ration, which was low in fat, the fat content of the milk on normal rations ranged from 2.327 (period 7) to 3.437 per cent (period 3), a difference of 1.11 per cent. This, it is believed, can not be attributed to the slight differences in the composition of the ration, but supports the theory that different feeding stuffs have a specific action sufficiently strong to affect the value of a ration. In determining the value of a feeding stuff, not only the proportion of nutrients must be considered, but also the specific action of the material, and this can be determined only by direct experiment, at least until we understand the principle on which this specific action rests.

As to the relative value of the new feeding stuffs tested, the cocoa-molasses proved to be a good and cheap concentrated feed for cows; the molasses-distillery-waste in the form in which it was used gave a negative result; the corn bran was eaten readily by the cows in large quantity without ill effect, and as it appeared to have a favorable effect on milk secretion it can be recommended; and the blood-molasses is to be regarded as a most valuable concentrated feed.

The comparative value of buckwheat middlings, dried brewers' grains, and Cerealine for milk and butter production, H. HAYWARD and R. J. WELD (*Pennsylvania Sta. Bul. 41, pp. 18, dgm. 1*).—The experiment was with 12 cows and covered 3 periods of 40 days

each. A constant basal ration of 3 lbs. corn meal, 1 lb. linseed meal, about 9 lbs. hay, and corn stover *ad libitum* was fed throughout. During the first and third periods all the cows were fed 4 lbs. buckwheat middlings per head in addition to the basal ration. During the second period 4 cows were fed the same ration as in the first and third periods, 4 were fed 4 lbs. brewers' grains, and 4 others 4 lbs. Cerealine, in place of the buckwheat middlings. Summaries of the rations actually eaten, the computed digestible matter of the rations, and the yield of milk are presented in tabular form, and a diagram is given representing the amount of fat produced by each cow throughout the experiment. Following are the conclusions reached:

"(1) The results of this experiment indicate that, for milk and butter production, dried brewers' grains, buckwheat middlings, and Cerealine are equally valuable when fed judiciously, as part of a balanced ration.

"(2) So far as could be observed, none of these foods produced a detrimental effect upon the flavor or quality of the milk and butter.

"(3) In view of the results stated, the choice of the above-mentioned foods would depend entirely upon their cost delivered at the railroad station.

"(4) With prevailing prices for dairy products and food stuffs, and with good cows, milk and butter can be produced at such a cost as to leave a considerable margin of profit for the dairyman."

Tests of dairy methods and apparatus, J. W. HART (*South Carolina Sta. Bul. 33, pp. 13*).—The feeding and care of cows, the testing of milk, and making of butter, and other topics connected with dairying are discussed in a general way. Pasteurized milk was treated with Hansen's lactic ferment, but it was considered that this failed to improve the flavor of the butter. It was believed that better results were obtained by using a fermentation starter from skim milk than by using sour buttermilk, sour cream, or leaving the ripening to the action of the germs adventitiously present. Experiments were conducted to compare different methods of making butter and to test different cream separators. Churnings were made of whole milk and of cream obtained by deep setting and by the use of four different separators. Of 17 churnings of whole milk the buttermilk contained on the average 1.5 per cent of fat, a loss of 30 per cent of the fat contained in the milk. The skim milk from 5 deep settings showed an averge fat content of 0.98 per cent. It was thought that there was no difference in the churnability of the cream from the various separators. In hot weather the use of ice in churning increased the quantity and improved the quality of the butter. Cream showing an acidity of 0.7 per cent by Farrington's alkaline tablets yielded the most butter. In one experiment the the same quantity of milk, about 4 gal., was put in each of 2 churns, one having a capacity of 10 and the other 60 gal., the other conditions being as nearly identical as possible. Over 7 per cent more finished butter was obtained from the larger churn, hence the author concludes that a churn should not be filled over one-third full. "The separator butter was usually scored higher than that made from whole milk, but

the difference was slight." Of the 5 separators used the best results were obtained from the Alpha De Laval Humming Bird Separator, which left only 0.084 per cent of fat in the skim milk as an average of 3 tests. No difference was observed in separating the cream immediately after milking or after a period of 12 hours, but better results were obtained by heating the milk to 160° before separating.

Gravity or dilution separators, H. H. WING (*New York Cornell Sta. Bul. 151, pp. 35-47, fig. 1*).—Reference is made to work on cream raising by dilution reported in Bulletin 39 of the station (E. S. R., 4, p. 361). Descriptions are given of Wheeler's Gravity Cream Separator, Hunt's Improved Ventilated Cream Separator, and the Aquatic Cream Separator, with the claims of the manufacturers. The first two "separators" are considered similar in all essential features to the Cooley, Moseley, and other cans used in deep setting; the Aquatic differs in being provided with another smaller can intended to be filled with ice and inserted in the large can as a cooler. Fifteen tests were made of the Wheeler and Hunt cans in comparison with Cooley cans, and 5 of the Aquatic. Tests of other cans were also made at various farms. The data obtained are tabulated and discussed. The following conclusions were reached:

"Gravity or dilution separators are merely tin cans in which the separation of cream by gravity process is claimed to be aided by dilution with water. Under ordinary conditions the dilution is of no benefit. It may be of some use when the milk is all from 'stripper' cows, or when the temperature of melting ice can not be secured. These cans are not separators in the universally accepted sense of that term, and can not rank in efficiency with them. They are even less efficient than the best forms of deep-setting systems, such as the Cooley Creamer. They are no more efficient than the old-fashioned shallow pan, but perhaps require rather less labor. In all probability they would give better results if used without dilution and immersed in as cold water as possible, preferably ice water."

The relation of certain bacteria to the production of butter, C. H. ECKLES (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 19, pp. 730-734; 20, pp. 759-763*).—Experiments are reported with the use of 4 species of bacteria in butter making, viz, *Bacillus subtilis*, *B. vulgatus*, No. 13 obtained from milk from the Iowa Agricultural College creamery, and *B. lactici-acidi*. The effects of the first two were bad, producing "butter of no market value. It is a significant fact that these are species closely connected with dirt and filth." The other two, both belonging to the lactic acid group, produced butter of fine quality, with an unusually pleasant aroma.

"The full effect of *B. subtilis* and *B. mesentericus vulgatus* is not reached until from 3 to 5 days after manufacture. This shows that an examination made at once after churning is misleading. No. 13, which produces such a marked and pleasant aroma when grown in milk, gives much less aroma to butter than does No. 8, which has but slight aroma in milk."

The rôle of lactic-acid bacteria in cheese ripening, H. WEIGMANN (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 15–16, pp. 593–607; 17–18, pp. 669–674; and Milch Ztg., 27 (1898), No. 42, pp. 660–663; 43, pp. 673–675; 45, pp. 706, 707*).—This is an extended discussion of the part played by lactic-acid bacteria in cheese ripening, with special reference to von Freudenreich's work. The author concludes from his review of the subject and from his own work that—

(1) The specific lactic-acid bacteria are not cheese-ripening bacteria, the form used by von Freudenreich in his experiments being only facultative or more probably degenerate lactic acid bacteria.

(2) Lactic-acid bacteria have an important rôle in cheese ripening, not in actually taking part in the ripening, but by directing the process in the right direction.

(3) This function consists in eliminating certain forms of bacteria and fungi by the lactic acid formed, and providing an acid nutrient medium upon which only such bacteria and fungi can thrive as can withstand the acid or consume it. The micro-organisms which consume the acid prevent its accumulation in too strong a degree, take part in the peptonizing and flavor-producing processes, and enable other bacteria or fungi whose activity was weakened by the acid to continue their work.

(4) The specific character of a particular kind of cheese depends upon the predominating form of micro-organism which the manner of preparation and the handling of the cheese have brought about.

Preliminary report of tests of the Thistle milking machine, B. MARTINY (*Mitt. Deut. Landw. Gesell., 13 (1898), No. 18, pp. 281–285; and Milch Ztg., 27 (1898), No. 42, pp. 657–660*).—Two tests of 77 and 40 days, respectively, were made on a private estate, 10 of the heaviest milkers being selected from a herd of 120 Dutch cows. In each test the cows were milked in alternate periods by hand and with the machine. The results as to yield and fat content of the milk are fully tabulated for the individual cows. The machine was found satisfactory and did not cause any disturbance or shrinkage of the cows. There is believed to be greater difficulty in keeping impurities out of the milk, especially micro-organisms, than with hand milking, and it is recommended to pasteurize machine-drawn milk immediately after milking. It is questioned whether in the case of young cows machine milking will make as good milkers as hand milking. As the machine is complicated and requires to be carefully looked after, the author doubts whether it simplifies or lightens the management of a dairy farm, provided good hand milkers can be procured.

Passburg's dry milk (Trockenmilch), G. BAUMERT (*Ztschr. Angew. Chem., 1898, No. 13, pp. 297, 298*).—Analyses are given of this product made by evaporating milk at a low temperature without the addition of any foreign material, and of tablets made from it by mixing with it a little cocoa, sugar, etc. The product is said to keep well.

Preparation of casein from skim milk (*Chem. Ztg., 22 (1898), No. 87, p. 930*).—Three patents have been granted in England to H. Higgins for the preparation of casein from skim milk by means of hydrochloric acid, in the proportion of 5 lbs. of acid to 100 gal. of hot skim milk (130 to 140° F.); and the manufacture of several dried food products from it, either alone or mixed with flour, rice, tapioca, sugar, aromatic substances, etc.

Comparative tests of butter fat, F. S. SHIVER (*South Carolina Sta. Bul. 33, pp. 13, 14*).—A comparison of the Babcock test and the Adam's gravimetric method on whole milk, skim milk, and buttermilk. "The Babcock method with the machine used gives very satisfactory results as compared with the gravimetric method." The average percentages of fat by the two methods were as follows:

Fat content by Babcock and gravimetric analysis.

	No. of comparisons.	Gravimetric.	Babcock.	Difference.
		Per cent.	*Per cent.*	*Per cent.*
Whole milk	49	4.77	4.83	0.06
Skim milk by deep setting	5	1.05	1.15	.10
Buttermilk	4	1.50	1.58	.08

"These differences between the two methods are within the limit of error between duplicate determinations by the gravimetric method in current work."

Correction of the reading of the Babcock test for cream, W. J. SPILLMAN (*Washington Sta. Bul. 32, pp. 3–5*).—It is pointed out that while the 17.6 cc. pipette used in the Babcock test delivers 18 gm. of milk, with cream "the pipette fails to deliver 18 gm. because cream is so much lighter than milk; hence the test reads considerably lower than it should, and the richer the cream the greater the error." The author proposes to overcome this by correcting the reading by a table, which he gives for this purpose. The table gives the correction to be made and the corrected reading for cream containing from 10 to over 70 per cent of fat. The method by which the table is calculated and its use in practice are explained.

Effect of richness of cream on acid test, W. J. SPILLMAN (*Washington Sta. Bul. 32, pp. 5–7*).—The failure to obtain uniform results with cream ripened to the same degree of acidity but differing in richness is explained on the ground that "the acid of the cream is all contained in that part of the cream that would remain if the fat were all removed, *i. e.*, in the serum," and that accordingly "bacterial action has progressed twice as far in 60 per cent cream as in 20 per cent cream when they show the same degree of acidity by the test." A table is given showing the actual degree of acidity of cream of different richness as compared with 25 per cent cream testing 6 degrees of acidity. The practical use of the table in butter making is explained.

Testing of cream with Dr. Gerber's acid-butyrometry, M. KÄMRITZ (*Milch Ztg., 27 (1898), No. 44, pp. 694, 695*) —A description of the method of testing cream with comparison with the gravimetric determination.

Use of pure cultures in butter making, F. S. COOLEY (*Massachusetts State Bd. Agr. Rpt. 1896, pp. 169–176*).—A popular address on dairy bacteriology, in which is mentioned a single comparative test of Conn's Bacillus 41, natural ripening, and a bacillus isolated at the Massachusetts Dairy School at Amherst. The results showed only slight differences in the flavor of the butter.

The practical side of dairy bacteriology, J. P. SHELDON (*Dairy, 10 (1898), No. 118, pp. 279, 280*).—A popular article.

Report of Swedish butter exhibitions for the year 1897, N. ENGSTRÖM (*Meddel. K. Landtbr. Styr., 1898, No. 44, pp. 44*).

Colored spots in cheese, R. A. PEARSON (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 24, pp. 6*).—A description based upon reports received at the office of cheese rust or colored spots of cheese, with evidence of the bacterial cause of the affection and a discussion of remedial and preventive measures. "So far as is known, these spots do not have any effect on the consumer." The destruction of the objectionable germs by the thorough cleaning and disinfection of factories is considered the only perfect remedy.

The spread of typhoid fever by milk, RAPMUND (*Ztschr. Medicinalbeamte, 1897, No. 15; abs. in Hyg. Rundschau 8 (1898), No. 7, pp. 351–353*).

The dairy interests of the United States, H. E. Alvord (*Masssachusetts State Bd. Agr. Rpt. 1896, pp. 136–164*).—An address delivered before a public meeting of the State Board of Agriculture reviewing the growth of the dairy interests of the United States during the last seventeen years and considering some of the reforms and improvements desirable or essential to future welfare.

Dairying in Denmark during 1897, B. Bögglid (*Tidskr. Landökon., 17 (1898), No. 1–2, pp. 56–87*).

Report of the dairy agency in Manchester to the Swedish Agricultural Department for 1897, H. Wedin (*Meddel. K. Landtbr. Styr., 1898, No. 47, pp. 71*).

VETERINARY SCIENCE AND PRACTICE.

The lung and stomach worms of sheep, J. E. Wing (*Ohio Sta. Bul. 91, pp. 163–178*).—In the introduction, which is by C. E. Thorne, it is stated that a disease caused by parasites in the lungs and known as "paper skin" or "white skin" has prevailed among sheep for an indefinite period, affecting lambs and yearlings chiefly. Citations are given from several papers.

The author describes the lung parasites: White threadworm (*Strongylus filaria*), the red threadworm (*S. rufescens*), and the hair worm (*Pseudalius ovis*); and the stomach worm (*Strongylus contortus*). The fact is recognized that there is no certain cure for lung disease. The practice of smoking or fumigating lambs for lungworms is regarded by some with considerable favor. The more promising treatment, according to the author, consists of injecting into the windpipe a mixture of 2 parts olive oil and 1 part turpentine. From 1 to 3 teaspoonfuls is sufficient for a dose. A hypodermic syringe may be used for injecting. The experience of the author is quoted to show that if an intermediate host is necessary for the development of the lungworm, the period passed in the intermediate state is not necessarily very long. A number of strong, healthy ewes and large young lambs were put on a high rolling blue grass pasture of 40 acres. No sheep had been on this pasture the preceding year and, so far as known, sheep infested with parasites had never been pastured there. The grass was very luxuriant and the grazing was largely confined to a slope near a spring. The ground was thickly strewn with droppings and probably became infected from the sheeps' nostrils as well. The sheep drank from the stream flowing from the spring. After a time some of the older lambs died quite suddenly. During June and July a number of lambs were born on the pasture and they seemed to thrive at first, but in about 45 days showed symptoms indicating the presence of the lungworm and, though treated with the usual remedies, they died. The older lambs were removed from the pasture and continued to thrive and the ewes remained healthy. In the author's opinion the young lambs obtained the parasites from the short grass and possibly from the water in the stream. "It is evident that older sheep in seeming perfect health may infect lambs with lungworm (and doubtless stomach worm) to a fatal extent, and this during a single season."

The stomach worm is described at length. The symptoms caused by its presence vary considerably. "There is disarrangement of the digestion, which may cause either scouring or constipation. Frequently the constipation succeeds the scouring. The lambs have abnormal appetites, eating irregularly, sometimes very little, then unusual amounts. They often eat rotten wood, earth, etc., and in fact this is the most characteristic symptom. The skin becomes pale, the strength declines, the flesh disappears, the wool is sunken and lusterless. For some reason there seems a greater mortality among ram lambs than among ewe lambs. Few lambs that reach the stage of emaciation ever recover or are of any value if they do recover. In some cases death is quite sudden, in others the lamb lingers for weeks or months."

One of the most common remedies for stomach worm is 1 part turpentine to 16 of milk, given in doses of 1 to 3 oz., according to the size and age of the lamb. The author does not regard this remedy as at all certain. "Seemingly good results, in truth the best results ever observed in practice have been obtained by using the following mixture: Pine tar, 8 parts; raw linseed oil, 8 parts; turpentine, 1 part. The dose is from 1 to 3 oz." The fact is pointed out that measures which prevent infection are much more promising than internal remedies. The lambs should be kept as much as possible from contaminated food or drinking water.

"It must be constantly borne in mind that these parasites are present in nearly or quite all flocks, even in times of health. The older sheep may not suffer perceptibly from the presence of the small number of strongyli, yet they are constantly passing the eggs with their excrement and thus polluting the herbage for how long a time we do not know—for at least one year we are certain. If sheep have fresh pasture each year there is not the same opportunity for the young worms to find entrance into the lambs, and thus the number will constantly decrease from year to year.

"If, on the other hand, sheep are made to feed over their own droppings from year to year, the worms will increase rapidly in numbers and will sooner or later become sufficient in number to nearly destroy the lamb crop.

"The practical lesson is, that it is better to have the lambs dropped as early as possible in winter, supposing that food and shelter suitable are provided, for in winter there is very little likelihood of their becoming infested with parasites; then they should be pushed rapidly forward while suckling their mother, and weaned, if of suitable age, when first ready to turn on grass. They ought then to have fresh pasture that has had no sheep on it for two years, or at least that had no sheep the preceding year, and no old sheep should be pastured with the lambs."

Methods of combating communicable diseases of farm animals, R. R. DINWIDDIE (*Arkansas Sta. Bul. 51, pp. 35–46*).—The cause and origin of communicable diseases, general methods of prevention and control, innoculation against anthrax or charbon, and prevention and control of Texas cattle fever are briefly touched upon. The methods of control, etc., noted are such as are applicable to all contagious animal diseases and such as should readily suggest themselves to intelligent owners of live stock; but, in the author's opinion, they are generally

neglected or carried out in a half-hearted manner and are therefore ineffectual.

Communicable diseases, aside from the primary cases (disease germs), are noted as due to the introduction of diseased stock, exposure of animals to diseased stock of neighbors, to infected drinking water, and such miscellaneous agencies as man, dogs, birds, insects, etc. Proper isolation, the use of water from deep wells, runs, or pastures of sufficient size, and disinfection of pens, are insisted upon.

Anthrax is not thought to be endemic in this country. Inoculation against it is not regarded with favor, since there seems to be danger of continuing the disease by this means.

Texas fever may be controlled by washes of pyrethrum, kerosene emulsion, and kerosene emulsion in connection with the liberal use of a currycomb and hand picking. Dips are not thought successful. The presence or absence of ticks in the region is not thought a reliable test for the presence or absence of the disease. For noninfectious diseases the method is the obvious one of introducing no stock from infected localities.

Tuberculin investigations in Sweden, J. SVENSSON (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 229–240*).—The first systematic tests in Sweden for tuberculosis by the injection of tuberculin were made in April, 1895. During the following 2 years and 2 months 35,992 cattle, distributed on 1,117 farms, have been inoculated. Of this number 52.6 per cent did not give any reaction, 5.2 per cent were doubtful, and 42.2 per cent gave a decided reaction. The animals examined were largely in herds on large estates. There were many small herds where no tuberculous animals, or only 1 or 2 per cent, was found. The author believes that the percentage of tuberculous cattle for the whole country is below 20.—F. W. WOLL.

Bacteriological work, F. D. CHESTER (*Delaware Sta. Rpt. 1897, pp. 38–42*).—The preparation of anthrax vaccines is briefly described, and bacteriological examinations of 12 samples to determine anthrax reported.

A study of National and of State legislation on anthrax, A. T. NEALE (*Delaware Sta. Rpt. 1897, pp. 8–19*).—Reprint of Bulletin 37 of the station (E. S. R., 10, p. 396).

On the influence of potable water of varying chemical composition upon the virulence of splenic fever bacilli, P. DROSDOWSKI (*Vrach, 1898, No 3*).

Hog cholera, G. A. WATERMAN (*Michigan Sta. Bul. 157, pp. 323–328*).—A general discussion of the subject, including the cause, symptoms, treatment, disposal of the carcasses, and methods of cleaning the pens where infected animals have died. The favorable results attending the injection of serum from immune animals are mentioned.

Glanders of Droes, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 13 (1898), No. 8, pp. 453–460*).—A general article, giving symptoms and treatment. Citations from the "Animal disease act" are given.

Tuberculosis in cattle and its control, J. LAW (*New York Cornell Sta. Bul. 150, pp. 30, pls. 2, figs. 3*).—A general discussion, summarizing the present knowledge of the subject. The author's experience in eradicating tuberculosis from two herds with-

out the use of tuberculin test is reported in detail. The importance of the tuberculin test is, however, insisted upon. The need of State legislation is discussed, the author believing that stock in New York are menaced by the lack of proper legislation, since herds are being infected by the introduction of cattle brought from other regions where there are strict laws upon the subject.

The appearance in the blood serum as the effect of chemical products of a substance capable of agglutinating the tuberculosis bacillus, S. ARLOING (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 22, pp. 1550–1555*).—Experiments with goats are briefly reported.

Tuberculosis, D. MCCRAE (*Rpt. Agr. New Brunswick, 1897, pp. 243–257*).—A general article on tuberculosis and the importance of the tuberculin tests, together with a discussion.

Tuberculosis in spayed cattle, W. C. QUINNELL (*Queensland Agr. Jour., 3 (1898), No. 4, pp. 317, 318*).—The author points out the danger of infection with tuberculosis when cows are spayed. The necessary precautions are briefly pointed out. The article is based on the author's experience.

The Royal Commission on tuberculosis, J. MCFADYEAN (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), Pt. II, No. 34, pp. 323–344*).

The effect of smoke upon the life of tuberculosis bacilli in meat, FORSTER (*Deut. Med. Wchnschr., 24 (1898), No. 11, Vereins Beilage, No. 8, pp. 47; abs. in Ztschr. Fleisch u. Milchhyg., 8 (1898), No. 10, pp. 188, 189*).—Experiments on the effect of smoke and the moisture content of the air are reported.

Studies on rabies: I. Inoculation experiments with wolves, E. DI MATTEI (*Arch. Hyg., 33 (1898), No. 3, pp. 266–314*).—A large number of experiments are reported.

Roup and roup antitoxin (*Philadelphia, H. K. Mulford Co.*).

Gastro enteritis in cattle due to worms, MCFADYEAN (*Jour. Comp. Path. and Therap., 1897; abs. in Ztschr. Fleisch u. Milchhyg., 9 (1898), No. 2, pp. 30, 31*).

Laminitis, fever in the feet, founder, etc., D. HUTCHEON (*Agr. Jour., Cape Good Hope, 13 (1898), No. 8, pp. 448–453*).—The diseases, symptoms, and treatment are discussed.

The anaerobism of tetanus bacilli, J. FERRÁN (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 1, pp. 28, 29*).

Certain biological and animal pathogenic characteristics of Bacillus proteus, M. MEYERHOF (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 1, pp. 18–27; 2–3, pp. 55–61; 4–5, pp. 148–154*).—An extended study of the subject, with bibliography.

The nature of the antagonism between toxins and antitoxins, C. J. MARTIN and T. CHERRY (*Proc. Roy. Soc. [London], 63 (1898), No. 400, pp. 420–432*).—A number of experiments are reported.

AGRICULTURAL ENGINEERING.

The loss of water from reservoirs by seepage and evaporation, L. G. CARPENTER (*Colorado Sta. Bul. 45, pp. 32, fig. 1*).—A record is given of observations on seepage from a series of reservoirs near Fort Collins in the winters of 1895–96 and 1896–97, and on evaporation from the reservoirs and from an evaporation tank. The results are discussed in detail and summarized as follows:

"The seepage losses may be great. In the lakes under measurement the losses in some cases were less than from evaporation alone. In some cases lakes may gain from seepage from irrigated lands, and the gain may be more than the combined loss from seepage and evaporation. In the cases where loss from seepage occurred, the loss was at the rate of about 2 ft. in depth over the area of the lake per year. This

amount does not necessarily apply to other sites, and other observations are needed before general statements respecting loss from this source can be made.

"The seepage decreases after the lake is first filled, from the effect of silting and from having filled the porous ground underneath and connected with the site. Even in sand there is a limit to the amount of seepage, and the time during which the loss is large. After sand beds connected with the reservoir are saturated the losses from seepage will decrease. The loss increases with the depth, probably nearly as the square. The losses may be lessened, though not entirely prevented, by silting. The silting process is more efficient with small reservoirs, because of the better distribution of the silt.

"If the loss from seepage is not more than 2 ft. per annum, the sites may be considered as practically water-tight. In the case of canals the losses often average more than that in 24 hours.

"The losses from evaporation in the cases examined are greater than those from seepage, and the evaporation is not necessarily the same from adjacent bodies of water. The amount of evaporation increases with the temperature of the water, with the wind, and diminishes with increased moisture in the air. From the standard evaporation tank at the experiment station, the average evaporation for 11 years has been 41 in.

"Evaporation proceeds when the water is frozen, but at a diminished rate, averaging about 1 to 1½ in. per month. The evaporation at night is the same as during the day, the difference being less with the increase of the size of the bodies of water.

"The loss by evaporation from several lakes exceeded that from the standard tank, the loss from the lakes being about 60 in. per year. The increase is due to higher temperature of the water and to freer exposure to the wind. In some of the summer months the lakes lost twice as much as the standard tank. The lower temperature of water at high elevations, and the lower dew points, tend to decrease the evaporation.

"The diminished barometric pressure tends to increase the evaporation, amounting to 14 per cent at 8,000 ft. and to 18 per cent at 10,000 ft. over the evaporation at 5,000 ft.

"Since the winter period is longer at the high elevations, it is probable that for the whole year the evaporation is considerably less at the high elevations than at the low ones.

"Every mile of wind movement in 24 hours increases the evaporation by from 1 to 2 per cent over the evaporation if calm. Evaporation is lessened by any influence which diminishes the wind or decreases the temperature of the water. Protection of lakes by wind-breaks is in many cases practicable and in small lakes sometimes desirable. In the large lakes the benefit is by reducing the wind velocity; in small lakes both from effect on wind and by lessening action of sun.

"The deeper the lake the cooler the water as a whole, the cooler the surface, consequently the less evaporation.

"Assuming a loss of 5 ft. in depth per annum, an area of 100 acres would require ¾ cu. ft. per second for the whole year to make good the losses from evaporation; one of 500 acres would require 3¾ cu. ft. per second, considerably more than would be used to irrigate an equal area.

"The net loss to the reservoir would be the sum of the above losses from seepage and from evaporation, diminished by the rainfall, a combined loss which may be considered as a depth of 6 ft. in one year. As irrigation reservoirs are usually full for a few months only, the loss is much less than this for the high water area."

Object-lesson roads, R. STONE (*U. S. Dept. Agr. Yearbook 1897, pp. 373–382, pls. 2, fig. 1*).—This is an account of the construction of short sections of roads to serve as object lessons at New Brunswick, Florence, and Englishtown, New Jersey; Geneva and Ilion, New York; Warren, Pennsylvania, and Kingston, Rhode Island, with remarks on State aid to road building in Massachusetts, and suggestions regarding the construction of a coastwise and transcontinental highway to serve as a national object lesson.

Cold storage (*Rpt. Com. Agr. and Dairying, Canada, 1897, pt. 5, pp. 87, figs. 50, pls. 6*).—The different uses, methods, and applications of cold storage are discussed, plans are given for construction of ice house, refrigerator room, cold-storage room for a creamery, and cold-storage buildings of several kinds.

Preliminary results of trials of mowers, horserakes, and hay-turning machines at Stend, Norway, 1898, N. SVERDRUP (*Tidsskr. Norske Landbr., 5 (1898), No. 8, pp. 398–400*).

STATISTICS—MISCELLANEOUS.

Ninth Annual Report of Delaware Station, 1897 (*Delaware Sta. Rpt. 1897, pp. 232*).—This contains a financial statement for the fiscal year ending June 30, 1897, a report of the director, including a review of national and State legislation on anthrax, and reports of the various departments noted elsewhere.

Yearbook of the Department of Agriculture, 1897 (*U. S. Dept. Agr. Yearbook 1897, pp. 792, pls. 40, figs. 45*).—This includes a general report by the Secretary on the operations of the Department during the year; articles setting forth the work of the several bureaus, divisions, and offices; numerous semipopular articles noted elsewhere; and an appendix containing notes on the organization of the Department, a list of the agricultural colleges and stations in the several States, a list of the Department publications for the year, data on feeding, fertilizers, and fungicides; a list of one hundred of the most valuable trees in the United States, with their characteristics and uses and their preferred environment; tables showing the number and value of farm animals, the acreage and value of the principal crops, the imports and exports of agricultural products, and transportation rates. The volume has a comprehensive index.

Agricultural production and prices, G. K. HOLMES (*U. S. Dept. Agr. Yearbook, 1897, pp. 577–606*).—By means of statistical tables and discussion the author presents a review of the development of the agricultural resources of the United States; treats of various economic questions, as tenancy, wages, production, labor, and capital in reference to agriculture; and considers the economic use of fertilizers, and prices of agricultural products, pointing out influences that depress prices, viz: "Production increasing faster than population, necessitating the meeting of cheaper foreign agricultural labor in the world's market; cheaper transportation; cheaper cost of production due to machines and improved implements; reduced expenses of marketing; the dissemination of information and the multiplying of the means and facilities of transportation, preventing scarcity with respect both to time and place, and thus steadying prices."

Visit to Great Britain and Ireland (*Rpt. Com. Agr. and Dairying, Canada, 1897, pt. 6, pp. 32*).—Among other matter this bulletin gives statistics of the amount of foods imported into Great Britain during several years.

Constitutions and by-laws for farmers' organizations J. HAMILTON (*Pennsylvania Dept. Agr. Bul. 36, pp. 72, dgms. 2*).

Some books on agriculture and sciences related to agriculture, published 1896–1898 (*U. S. Dept. Agr., Office of Experiment Stations Circ. 38, pp. 45*).—A bibliographical list of more than 450 publications.

Agricultural outlook for the coast region of Alaska, W. H. EVANS (*U. S. Dept. Agr. Yearbook 1897, pp. 552–576, pls. 4*).—The substance of this article has already been issued as Bulletin 48 of this Office (E. S. R., 9, p. 1097).

On the development of Swedish agricultural technical industries during the past 25 years, A. G. EKSTRAND (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 4, pp. 203–246.*)

NOTES.

IOWA STATION.—C. F. Curtiss, director of the station, has been granted leave of absence for 3 months, beginning April 1, for a trip abroad to study the agricultural conditions of Great Britain and Western Europe.

KANSAS COLLEGE AND STATION.—E. E. Faville, horticulturist and entomologist in the college and station, has resigned to accept the presidency of the National Farm School at Doylestown, Pennsylvania, a new industrial institution under the auspices of a Jewish association. W. L. Hall, assistant horticulturist, and Percival J. Parrott, assistant entomologist, are temporarily in charge of the work in their respective departments. Mr. Parrott is studying scale insects in New Mexico. F. C. Burtis, assistant in feeds and feeding, has been granted leave of absence for a year to study in other agricultural colleges. His place will be taken temporarily by J. G. Haney. Geo. L. Clothier, assistant botanist, has been granted leave of absence until the first of June to study plant breeding at Cornell University. His place will be supplied by J. M. Westgate.

SOUTH CAROLINA COLLEGE AND STATION.—J. W. Hart, instructor in dairying, has resigned to accept a position in the Dairy School at Kingston, Ontario, and C. M. Conner has been assigned the duties of the dairy department in the college and station. J. V. Lewis, geologist, has resigned his connection with the station staff, in order to devote his entire time to the college.

TENNESSEE UNIVERSITY AND STATION.—Charles F. Vanderford, professor of agriculture in the university and secretary and agriculturist in the station, died January 3, 1899. Professor Vanderford had from long study become thoroughly familiar with the agriculture of his State, and for many years had been closely identified with all its agricultural interests. He was an enthusiastic student of those branches of natural science upon which agriculture is based, and during the last 30 years of his life gave his best efforts to the advancement of the farmer. He rendered valuable service in revising, correcting, and condensing a report upon tobacco, published in the Tenth Census of the United States. He was for many years president of the Tennessee Stock Breeders' Association, and from 1889 to 1891 was assistant commissioner of agriculture of the State. He had been connected with the university and station since 1891. John R. Fain has been appointed to succeed John L. Spinks as farm manager. At the last meeting of the board of trustees of the university an order was made for the establishment of a system of farmers' institutes. The experiment station staff are at work perfecting plans, and the first institutes will be held during the winter and spring.

NECROLOGY.—Dr. Carl Brunnemann, director of the agricultural institute at Itabira-de-Mata-Dentro, Brazil, died October 27, 1898. Dr. Brunnemann was formerly director of the agricultural experiment station at Posen, Germany. In 1891 he was engaged by the Brazilian Government to organize an agricultural experiment station at Barbacena, in the Province of Minas-Geraes. He was quite widely known through his investigations in Minas-Geraes, and his travels. In 1894 he established the agricultural institute at Itabira.

Dr. C. G. Gibelli, professor of botany and director of the Botanic Institute of the University of Turin, died September 16, 1898.

Gilbert H. Hicks, assistant botanist of this Department, in charge of seed investigations, died December 5, 1898.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director.*

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
——— ——— —Entomology and Veterinary Science.
R. A. EMERSON—Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 7.

It is learned from a recent official report that steps are being taken in Russia for the establishment of a system of agricultural experiment stations under the supervision of the Imperial Government. The ministry of agriculture has elaborated a plan for such a system of institutions, which has been passed upon and approved by the agricultural council. In accordance with the usual course of events in that country, this action will be followed at an early date by the issue of a royal decree definitely inaugurating the system.

The plan proposed and approved provides for four classes of institutions, namely: (1) agricultural experiment stations for scientific investigation of problems in agriculture, chiefly by laboratory methods; (2) experimental fields (or orchards and gardens) for making field experiments in the culture, etc., of agricultural crops, with a view to solving technical questions of a more local character; (3) semiscientific experiment farms, for conducting practical experiments in general farm management under local conditions, studying economic questions, etc.; and (4) fields of demonstration (also orchards and gardens of the same character) for demonstrating the application in practice of the results of experiment station work, improved methods which have been tested on the experimental fields, new kinds and varieties of valuable plants, breeds of animals, farm implements, etc. Where desirable these four types of stations may be united into one institution with the several departments.

The stations may be divided again, according to the scope of their work, into (1) those which are working on the fundamental principles underlying the practice of general agriculture, and (2) those which are studying, by similar methods, questions of a more local character. Stations of the first class will be located in the vicinity of the centers of scientific learning, and those of the second class in typical agricultural regions and, where possible, near the local centers of education.

The experiment stations are to be provided with laboratories, collections, libraries, and other facilities as required by their particular lines of work. In some cases they will be provided with departments of agricultural meteorology. They will have under their direction small tracts of land (only a few acres) as required for their work. Aside from their regular investigations they will make analyses of soils, fer-

tilizers, agricultural products, etc., for private persons, according to a fixed schedule of prices.

The experimental fields will be established in regions which are typical in regard to soil, topography, and other conditions. They will have a considerable tract of suitable land (up to 160 acres), according to their special purpose, and where necessary to the work being done they will have laboratory facilities for making simple analytical determinations.

The experiment farms will correspond in general character to the farms or estates of the localities in which they are located. There may be affiliated with these farms special departments for horticulture, gardening, and agricultural technology, and also for introducing improved breeds of animals, implements and machines, distributing seeds of improved varieties, etc. The experimental fields and farms will conduct meteorological and phenological observations.

The fields of demonstration are to be established near localities which are most visited by the rural population, and preferably in connection with educational institutions.

The experiment stations will each have a director and at least two assistants. The experimental fields and farms will each have a director and at least one assistant. So far as possible these will be selected from persons who have received an education in agriculture or the natural sciences. The managers of the fields of demonstration will, where practicable, be chosen from the local residents, and will be under the supervision of a specialist. Provision is made for the formation of councils for such experiment stations as have experimental fields and farms, to be composed in each case of the director and his assistants, a representative of the ministry of agriculture, persons who have aided in establishing the station, and other persons selected by the council. The general plans for work for terms of four or five years are presented by the director to the council, and later to the minister of agriculture for his approval. The approval of the annual plan of operations is left to the council. Where there is no council the director presents his plan of work, as well as his annual report, directly to the minister of agriculture for approval.

Arrangements may be made for the holding of public lectures and courses in various branches of agriculture at the experiment stations, under the approval of the minister of agriculture.

The experiment stations, fields, farms, etc., may be established by the government, by local communities, or by private persons. Those established by communities (zemstvos), organizations, and private persons may receive pecuniary or other aid from the ministry. The experiment stations proper, owing to the complex nature and comprehensiveness of their work, will be established chiefly by the government. The establishment of experimental fields will be left mainly to local communities, as also that of fields of demonstration. The ministry of agricul-

ture, through persons commissioned for the purpose, will exercise a supervision over the work and expenditures of the institutions which receive government aid. It will also publish an annual report of the work of the stations, and periodically will give a general survey of their operations.

It will be seen that while the government plans for the establishment and maintenance of the higher-grade institutions, it looks to local communities, organizations, and public-spirited persons for the establishment of fields and farms where the work is to be of a more practical and popular nature or for purposes of demonstration and is to be restricted to the study of local questions. After these more or less private institutions have been established they may receive government aid in the form of annual appropriations, chiefly for defraying the expenses of the staff of the station and purchasing books and scientific equipment, or they may be given the use of government lands, animals for breeding, seeds of improved varieties of plants, etc. They may also have the benefit of advice and information from the specialists attached to the ministry of agriculture.

The object of the institutions which the plan contemplates is a double one—that of experimental investigation on both scientific and practical questions in agriculture, and the dissemination of information among the common people by means of fields of demonstration, popular lectures, and publications. The scheme bears evidence of thorough familiarity with the history of the experiment station movements of other countries and the tendencies which have developed. In its elaboration the experience of these institutions has been profited by, and the successful features of different countries embodied. As a result, we have a comprehensive system of stations, fields, farms, etc., each class with a definite field of work and designed to serve a definite purpose in the advancement of the science and the practice of agriculture. Taken in connection with the proposed system for agricultural education, it will be seen that there is no confusion as to the work of education, investigation, application, demonstration, and the dissemination of popular information. The need for effort along each of these lines is recognized and separate provision for it is made in the schemes elaborated. When the condition of agricultural practice in Russia is considered—the primitive implements which are used, the irrational systems which are followed, and the general lack of progress as compared with that made in other countries—it can not but be apparent that the field of usefulness for institutions of the different classes contemplated is an unusually broad one, and that the movement will eventually result in great benefit to the agriculture of that country.

According to a recent Russian article on the agricultural experiment stations of that country, there are now in Russia sixty-eight stations of various kinds. The first station was established in 1864 at the

Polytechnicum at Riga. No other stations were established until 1878, when the experimental fields of the Petrov Agricultural Academy at Moscow were organized. The experimental fields of the agricultural institute at Novo-Alexandria, Poland, date from the following year. From that time on there has been a steady increase in the number of stations. The earlier stations owe their existence to zemstvos, societies, and private persons. Not until 1894 did the Imperial Department of Agriculture render assistance to the enterprise. In that year it took a considerable number of stations under its patronage, and began to open new stations in various localities in Russia. Since that time the development of these institutions has been quite rapid.

The Russian stations as they exist at present may be divided into three groups, (1) stations for general investigation, conducting experiments on their own fields, of which there are 43; (2) stations for special investigations, of which there are 14—3 for silk culture, 2 for apiculture, 2 for flax culture, 2 for bacteriological investigations, 1 for dairying, 3 for viticulture, and 1 for vegetable growing; and (3) control stations, of which there are 11. Some of the stations are wholly maintained by the government, while others are supported by local communities, societies, and private persons, in some cases with the aid of the ministry of agriculture. A number of the stations receive annual appropriations amounting to $2,800 from the government, and the Turkestan Station receives about $3,800 from that source.

Among the best-equipped stations are said to be the Plotyansk, Derebchinsk, Zapolsk, and Poltava stations for general work, the Tiflis Station for silk culture, the Edimonov Station for special work, the control stations at Warsaw, Riga, and Helsingfors, and the St. Petersburg Bacteriological Station.

The station staff usually consists of two persons, a director and an assistant, although in some instances there are additional regular assistants as well as volunteer assistants.

Aside from the inadequate number of stations (one station to 90,000 square kilometers) and their unequal distribution, which leaves important agricultural regions without any provision for experimental work, the absence of a unifying central institution is believed to be a great hindrance to their development. There is no general plan of organization. They have no organ for the publication of their results, and information regarding them is difficult to obtain. The experiment station movement which has been inaugurated by the ministry of agriculture should remedy these conditions, add materially to the influence of the stations already existing, and bring their work into closer touch with more advanced classes of agriculturists.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Methods of determining potash and the best precipitants of platinum, A. ATTERBERG (*Chem. Ztg.*, 22 (1898), No. 51, pp. 538, 539).—The article discusses the several methods that have been proposed for the determination of potash, in the light of experiments made by the author. The gravimetric methods are considered as a rule more satisfactory than the volumetric methods. Of the gravimetric methods the author considers that of Villiers and Borg (E. S. R., 5, p. 538) the best, of the volumetric methods that of de Koninck.[1] A method for determining potash directly in solutions containing iron and aluminum is also described. After freeing the solution from silica, it is evaporated to dryness with an excess of citric acid and sufficient platinum chlorid. The citrates of iron and aluminum are then taken up with alcohol, and the potash in the residue determined in the usual way.

As the result of numerous experiments made by himself, the author concludes that magnesium, mercury, and thioacetic acid are the best precipitants of metallic platinum from platinic solutions.—J. T. ANDERSON.

Modifications of the Kjeldahl method for determining nitrogen, A. ATTERBERG (*Chem. Ztg.*, 22 (1898), No. 50, pp. 505, 506).—The author records a series of experiments which were instituted to determine the relative value of a number of oxidizing agents. He concludes that the best means of oxidation is 20 cc. of concentrated sulphuric acid with 15 to 18 gm. of potassium sulphate and some mercury. The potassium sulphate may be added in the beginning except with substances which foam, when it should be added after solution has taken place. The solution becomes clear in about 30 minutes.—J. T. ANDERSON.

Contribution to investigations on manganese in minerals, plants, and animals, P. RICHARD (*Compt. Rend. Acad. Sci. Paris*, 126 (1898), No. 26, pp. 1882–1885).—The method which the author has previously described (E. S. R., 9, p. 1023) was applied to a number of soils, plants, and animal products with the result of showing the widespread distribution of manganese in nature. The hymenomycetous fungi appear to be especially rich in this substance, but other fungi and mosses are well supplied with it. Among vascular cryptogams the ferns are the most abundantly supplied. Of the gymnosperms the conifers are richest in manganese. Of the angiosperms the Gramineæ, Leguminosæ, Rosa-

[1] Chem. Ztg., 20 (1896), p. 502.

ceæ, Cruciferæ, Umbelliferæ, Ampelideæ, Solanaceæ, Liliaceæ, Polygonaceæ, and Urticaceæ are rich in manganese. It is abundant in oaks, elms, hornbeam, chestnuts, and poplars. The manganese appears to be concentrated in the leaves and young shoots (the active organs of vegetation). It is found in greatest abundance, however, in the seeds of flowering plants, such as wheat, barley, oats, maize, beans, buckwheat, hemp, coffee, figs, prunes, raisins, apples, and poplar and in fleshy roots, such as the potato. Manganese is present to a much less extent in animals than in plants. The egg yolk contains much more than the white. The egg as a whole contains more manganese than flesh or bone. Horny portions of animals, and in general skin with its associated parts, contain considerable amounts of manganese.

The quantitative separation of hemicellulose, cellulose, and lignin, and the occurrence of pentosans in these substances, W. HOFFMEISTER (*Landw. Vers. Stat., 50 (1898), No. 5–6, pp. 347–362*).—Following a discussion of the properties of these materials, the author describes their separation from sunflower-seed hulls. A large quantity of the hulls was extracted with ether, hydrochloric acid, and ammonia, and the residue was treated successively with 5 per cent sodium hydroxid (giving 2.78 per cent of hemicellulose), with Schweizer's reagent (giving 6.7 per cent of cellulose), and with hydrochloric acid and ammonia (giving 56.7 per cent of lignin). The hemicellulose contained 81.4 per cent of pentosan and the cellulose 54.5 per cent. Fifty grams of the lignin (insoluble residue) yielded, after treatment with dilute ammonia for 6 days, 1.91 gm. of hemicellulose containing 36 per cent of pentosans and 20.16 gm. of cellulose containing 2.18 per cent of pentosans. The ammoniacal extract and washings yielded 13.26 gm. of incrusting substance, and the undissolved residue of 14.21 gm. gave, on further treatment with ammonia, 2.30 gm. of cellulose. Hence the 50 gm. of lignin was found to consist of 24.37 gm. of cellulose and hemicellulose, and a residue comprised of incrusting substances and ash.

The author suggests that determinations of this sort may be of assistance in studying digestibility.

Studies were made on the effect of dilute ammonia on the cellulose bodies of lignin, and on the effect of dissolving cellulose in Schweizer's reagent on its solubility in sodium hydrate solution. Determinations are reported of the cellulose (Schweizer's extract) and lignin, and the proportions of pentosans in each of these, in clover at different stages of the first and second years of growth. These indicate an increase in both years in both the cellulose and lignin during the growing period. In the first year an absolutely as well as relatively larger amount of these substances was produced than in the second year. The amount of pentosans in the Schweizer extract was relatively higher the second year than the first, but the reverse was true for that in the lignin. All of the above results are believed to need confirmation.

Proceedings of the fourteenth annual convention of the Association of Official Agricultural Chemists (*U. S. Dept. Agr., Division of Chemistry Bul. 51, pp.*

169).—A detailed account, edited by the secretary of the association, H. W. Wiley, of the proceedings of the convention of this association, held at Washington, D. C., October 26–28, 1897, a summary account of which has already appeared (E. S. R., 9, pp. 404–414).

Progress in agricultural chemistry, W. SCHNEIDEWIND (*Chem. Ztg.*, *22* (*1898*), *No. 82, pp. 870, 871; 85, pp. 905–907; 86, pp. 911–913*).—Reviews briefly recent investigations on soils (especially the losses of fertilizing constituents from the soil), barnyard manure, green manures, and nitrogenous commercial fertilizers; on phosphoric acid, potash, and lime; on plant and animal production, and on analytical methods for fertilizers and foods. Most of the investigations referred to have been noted from time to time in the Record.

Report of the chemist, J. B. LINDSEY (*Massachusetts Hatch Sta. Rpt. 1897, pp. 74–78*).—Brief notes are given on the work of the chemical department, which included examination of a number of samples of water and milk, determination of starch, experiments with pigs, and a study of the feeding value of salt-marsh hay (E. S. R., 10, pp. 472–484).

Determination of phosphoric acid in superphosphates, L. VIGNON (*Bul. Soc. Chim. Paris, 3. ser., 19* (*1898*), *No. 20–21, pp. 860–862*).—This article has already been abstracted from another source (E. S. R., 10, p. 410).

Tables for calculating phosphoric acid from magnesium pyrophosphate. GÖLTSCHKE (*Tabelle zur berechnung der pyrophosphorsäuren magnesia auf phosphorsäure, Wiesbaden: C. W. Kreidel, 1896, pp. 20*).

Methods and solvents for the approximate determination of the probably available plant food in soils, W. MAXWELL (*Landw. Vers. Stat., 50* (*1898*), *No. 5–6, pp. 331–334*).—This article has been noted from another source (E. S. R., 10, p. 527).

Comparison of methods for estimating caffein, E. F. LADD (*Amer. Chem. Jour., 20* (*1898*), *No. 10, pp. 866–869*).—The author compares the methods of Peligot, Crosschoff, and Gomberg.

Determination of tannin, L. VIGNON (*Bul. Soc. Chim. Paris, 3. ser., 19* (*1898*), *No. 22, pp. 923–926*).

Method of determining starch in black and in white mustard seed, J. W. LLOYD (*Bul. Pharm., 12* (*1898*), *No. 11, pp. 497–499*).

Detection of formic aldehyde in food substances, E. RIMINI (*Ann. Farm., 1898, p. 97; abs. in Bul. Soc. Chim. Paris, 3. ser., 20* (*1898*), *No. 23, p. 896*).

The determination of dirt in milk, R. EICHLOFF (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1* (*1898*), *No. 10, pp. 678–683*).—Instead of Stutzer's sand filter, the author proposes to separate the foreign matter in milk by whirling samples of 300 cc. in a centrifugal run at the rate of 2,000 revolutions per minute, and to collect the sediment on an asbestus filter. Samples to be tested in this way must be perfectly sweet and, as a preservative, the author recommends potassium bicarbonate instead of formalin, as the latter is said to curdle a small part of the casein, which is then separated with the dirt.

Analysis of milk—determination of the amounts of added water, A. VILLIERS and M. BERTAULT (*Monit. Sci., 12* (*1898*), *Apr., pp. 270, 271; abs. in Jour. Soc. Chem. Ind., 17* (*1898*), *No. 7, p. 686*).

The value of Fleischmann's formula in milk analysis, E. ACKERMANN (*Milch Ztg., 27* (*1898*), *No. 49, p. 770*).—Remarks on the use of the formula in laboratory work.

Composition of the proteids of cereal and leguminous seeds: Practical results of the researches of E. Fleurent, A. LIVACHE (*Bul. Soc. Encour. Ind. Nat., 97* (*1898*), *pp. 547–550; abs. in Jour. Soc. Chem. Ind., 17* (*1898*), *No. 7, p. 685*).

Method for the quantitative determination of proteids in beer wort and other protein solutions, H. SCHJERNING (*Ztschr. Analyt. Chem., 37* (*1898*), *No. 7, pp. 413–422; abs. in Analyst, 23* (*1898*), *Dec., p. 326*).—In this paper the author summarizes the results of his previous work in this line, and presents a complete method for determining the different proteids in solution.

New contributions on the determination of fat in animal tissues and fluids, J. NERKING (*Arch. Physiol. [Pflüger], 73 (1898), No. 3-4, pp. 172-183*).—The author believes the only quantitative method for determining fat in meat to be digestion with pepsin and hydrochloric acid and subsequent extraction with ether, as suggested by Dormeyer (E. S. R., 7, p. 919). He proposes to simplify the extraction by the use of a somewhat intricate apparatus, which he illustrates and describes. The results of trials of the method on various kinds of meat, milk, etc., are reported.

Contributions to the analysis of fat. III, The detection of cotton-seed oil in lard, A. BÖMER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1 (1898), No. 8, pp. 532-552, fig. 1*).

The use of benzal in determining the iodin number of fats and the volatile portion of fatty acids, K. FARNSTEINER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1 (1898), No. 8, pp. 529-532*).

Creatin and its separation, E. F. LADD and P. B. BOTTENFIELD (*Amer. Chem. Jour., 20 (1898), No. 10, pp. 869-871*).

The quantitative estimation of sugar in meat and urine, E. POLENSKE (*Arb. K. Gesundheitsamte, 14 (1898), pp. 149-152; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 1 (1898), No. 2, pp. 782-784*).—The percentage of sugar in a number of samples of meat is reported, as well as the author's method of determining it.

On the detection and localization of phosphorus in animal and vegetable tissues, A. B. MACALLUM (*Proc. Roy. Soc. [London], 43 (1898), No. 400, pp. 467-479*).

Simple method of water analysis, especially designed for the use of medical officers of health, J. C. THRESH (*London: J. & A. Churchill, 1898, ed. 2 enl., pp. 55*).

A new filter flask, R. WALTHER (*Jour. Prakt. Chem., n. ser., 57 (1898), pp. 544, 545; abs. in Jour. Chem. Soc. [London], 74 (1898), No. 432, II, p. 507, fig. 1*).

A thermostat for high or varying gas pressure, D. BODINE (*Jour. Appl. Micros., 1 (1898), No. 11, pp. 193, 194, fig. 1*).—A simple and what is claimed to be a very efficient regulator is figured and described. It is claimed to be valuable where natural gas is used as a fuel or where for any cause the gas supply fluctuates.

BOTANY.

Experiments on the production of alpine characters in plants by the alternation of extreme temperatures, G. BONNIER (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 6, pp. 307-312, fig. 1*).—The author reports experiments with a number of plants in which he has attempted to produce alpine conditions by employing greatly reduced temperatures. The perennial plants used in the experiments were white clover, *Teucrium scorodonia*, and *Senecio jacobæa*. Among the annual plants experimented with were vetches, oats, and barley. The plan of the experiment was to grow these different plants in different exposures, the first being placed in a house, the glass front of which faced north and received only diffused light. The walls of this house were double and were filled twice a day with ice. In this way the temperature is kept at an average of 7° C. and the humidity about 90 per cent. The second lot of plants were exposed to the normal and variable conditions in the neighborhood, under which the temperature ranged from 15 to 35° and the humidity from 64 to 91 per cent. The third lot of plants were placed alternately in the ice house during the night and in the open during the day. These plants therefore had an alternation of temperature from 4 to 35°. The soil in the pots was maintained at the same degree of saturation as the others. The fourth lot of plants

were grown under the same conditions as the first, except that the spaces between the walls were filled with water instead of ice, giving an average temperature of about 16°. The different plants were planted on June 3, and by August 1 they presented markedly different aspects. All those which had received the alternate day and night temperatures were much smaller than those which had been kept at a uniformly low temperature or those grown under normal conditions. In the case of the germander the difference in growth is strikingly shown in the accompanying figure. In the fourth lot of plants, where water was

FIG. 14.—Effect of alternation of temperature on plants: 1, normal conditions; 2, constant low temperature; 3, daily variation of high and low temperature.

substituted for ice between the walls, the plants made almost normal growth. The effect of the different conditions on the growth of the plants is shown in the following table:

Effect of different temperature conditions on plant growth.

Lot.	Conditions of growth.	Germander. Average height of plant.	Germander. Average length of internode.	Vetch. Average height of plant.	Vetch. Average length of internode.	Oats. Average height of plant.	Oats. Average length of leaves.	Senecio. Length of basal leaves.	Clover. Length of longest leaves.
		Cm.	*Cm.*	*Cm.*	*Cm.*	*Cm.*	*Cm.*	*Cm.*	*Cm.*
1	Constant low temperature	24	5.5	38	4.8	35	0.8	13.5	17
2	Normal temperature	42	5.6	85	6.2	62	1	19	30
3	Alternate low and normal temperature	10	2.2	15	3	14	5	7	10
4	Constant medium temperature	38	5.5	80	6	50	9	15	30

Summarizing his results, the author states that plants kept at a very low temperature during the night and in the open during the day will be greatly reduced in size, their internodes will be proportionately shortened, their leaves much smaller and thicker, and they will flower much earlier. It is further stated that by an alternation of the temperature comparable to that which is produced on higher mountainous regions, it is possible to artificially produce alpine characteristics in plants grown at low elevations.

Half shade and vegetation, B. D. HALSTED (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 415*).—The author reports a number of experiments in shading various truck crops with frames of lath upon supporting stakes; the spaces between the lath equaling their width, so that half the direct rays are intercepted. In general, the shade retarded the germination of Lima beans in the first crop, but the opposite was the case with the second or midsummer planting. All root crops, such as turnips, carrots, and potatoes, had a larger leaf surface in the shade, but the roots were much smaller. The shade improved the growth of salad crops, such as lettuce, spinach, Swiss chard, etc., and celery was improved the most of all. The time of blooming was greatly retarded and the period of fruitfulness materially prolonged by shading beans, peas, eggplants, tomatoes, cucumbers, and the like. Leaves grown in the shade are usually of a deeper green color and thinner than those grown in full exposure.

A study of some wild plants was made in a wood lot and adjoining clearing. The cinnamon fern (*Osmunda cinnamomea*), was noted to have graceful, drooping leaves in the wooded land, while in the open they were nearly upright. Measurements of the thickness of the leaflets showed those in the shade to be 0.098 mm., while in the cleared land the thickness was 0.258 mm. Many other differences, such as hairiness, color of stems, etc., were noted between the shaded plants and those grown in the open.

Influence of carbon dioxid on the form and structure of plants, E. C. TÉODORESCO (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 6, pp. 335-338*).—The author reports upon a series of experiments in growing *Lupinus albus*, *Phaseolus multiflorus*, *Pisum sativum*, and *Faba vulgaris* under bell jars in an atmosphere containing carbon dioxid greatly in excess of the normal in one case and little or no carbon dioxid in another. Comparing the development of the plants, those grown in the presence of carbon dioxid had their hypocotyl, or lower internodes, greatly shortened, but the later internodes were elongated to such an extent that the total height of the plant greatly exceeded those grown without carbon dioxid. In addition, the internodes in cross section were much larger and contained a considerably greater number of fibro-vascular bundles, the leaves were much thicker, the cells of the palisade parenchyma were considerably elongated, and the intercellular spaces more extensively developed.

On the poisonous effect of the salts of copper on the higher plants, H. COUPIN (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 10, pp. 400, 401*).—Attention is called to the investigations of Roulin showing that the presence of 0.00416 per cent of sulphate of copper in water cultures is sufficient to destroy *Sterigmatocystis nigra*, and to the investigations of Millardet showing that the zoospores of mildew are destroyed by a solution containing 0.0000002 or 0.0000003 per cent of the same.

In the author's investigations recently germinated wheat plants were grown in water cultures containing different amounts of a number of copper salts. After a few days the plants were examined and readily showed the effect of the copper upon them. The minimum percentage of the different salts which is capable of destroying the plants is as follows: Copper bibromid, 0.004875; copper bichlorate, 0.005; copper sulphate, 0.005555; copper acetate, 0.005714, and copper nitrate, 0.006102. From these figures it is shown that there is practically little difference in the toxicity of the different copper compounds, and this the author believes is due to the copper ions.

On account of the recent recommendation that 5 to 10 per cent solutions of copper sulphates be used for the destruction of weeds, the author states that in view of the facts shown in his experiments great care should be exercised in following such directions, since the amount of copper might have an injurious effect upon wheat or other plants.

Elementary botany, G. F. ATKINSON (*New York: Henry Holt & Co., 1898, pp. XXIII + 444, figs. 509*).—This work, which is designed for use in secondary schools, follows the same lines as given in Barnes' Plant Life (E. S. R., 10, p. 416) in that the subject is treated from the standpoint of function, processes, and relationships of the plant, the main divisions given being morphology, physiology, and ecology. The book has many excellent features, not the least among them being the illustrations, most of which are new, and many produced by photographic process with excellent effect.

Particular attention is rightly given the study of the lower plants, but from the amount of space given the consideration of some groups they appear unduly exalted. Nearly as many pages are given to the consideration of the morphology of the ferns and their allies as to the consideration of the gymnosperms and the angiosperms. It seems very doubtful whether so much stress should be laid upon the recent cytological studies in secondary schools, most of which have neither apparatus nor instructors for this order of work.

Extreme measures have been taken with the scientific names of plants, although the author has not been entirely consistent in following them. It is doubtful whether anything is gained by extreme decapitalization and the use of Roman type for the technical names of plants; but if an author adopts such a plan it should be carried throughout and occasional lapses into italics avoided.

Botany at the anniversary meeting of the American Association for the Advancement of Science, E. F. SMITH (*Science, n. ser., 8 (1898), No. 202, pp. 651–660; 203, 690–700*).—Abstracts are given by the secretary of the papers presented before section F of the association at its anniversary meeting in Boston, August, 1898.

A manual of agricultural botany, A. B. FRANK, trans. by J. W. Patterson (*London: Wm. Blackwood & Sons, 1898, pp. X + 199, figs. 133; noticed in Amer. Nat., 32 (1898), No. 383, p. 883*).

The organography of plants, K. GOEBEL (*Organographie der Pflanzen. Pt. 2, Special Organography. Jena: G. Fischer, 1898, ill.*).

Medicinal plants which have been collected and used in North Carolina, C. W. HYAMS (*North Carolina Sta. Bul. 150, pp. 329-409*).—The author has given a descriptive catalogue of the plants which have reputed medicinal virtues and which are either native to the State or have become naturalized there. While many of the plants named are the source of regular officinal preparations, there is no doubt that many which are largely collected and used have little or no value. The bulletin is not intended to indorse the medicinal value of any of the species enumerated.

A new myxomycete in New South Wales, D. MCALPINE (*Proc. Linn. Soc. New South Wales, 12 (1898), No. 1, pp. 82-84*).—Notes the occurrence of *Physarum cinereum* on *Stenotaphorum americanum*, *Cynodon dactylon*, and *Kyllingia monocephala*.

The anatomical structure of the stem of beets, G. FRON (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 10, pp. 397-400, fig. 1*).—Comparative anatomical studies are reported upon *Beta vulgaris* and *B. maritima*, biennial plants, with *B. cycla*, an annual.

Concerning the red coloration of the stomata of Picea, P. SORAUER (*Notizbl. Bot. Garten u. Mus., Berlin, 2 (1898), No. 16, pp. 239-246*).—The author does not agree with Hartig that the red coloration of the guard cells is due to the presence of sulphurous acid in the air. He states that the red coloration of guard cells is not confined to the spruces, but has been observed in other conifers where factory smoke and fumes could not have exerted any effect. It is stated that sulphurous acid does influence chlorophyll production and may discolor the chlorophyll grain, but the author has no evidence to show that it becomes red on such account.

The nucleus of the yeast plant, H. WAGER (*Ann. Bot., 12 (1898), No. 48, pp. 499-544, pls. 2*).—The author states that all yeast cells contain a nuclear apparatus, which is figured and described.

Concerning the nucleolus of Spirogyra, C. VAN WISSELINGH (*Bot. Ztg., 56 (1898), No. 11-12, pp. 195-226, pl. 1*).—A contribution to the study of karyokinesis.

Structure and function of the beards on cereal grasses, B. SCHMID (*Bot. Centbl., 76 (1898), No. 1, pp. 1-9; 2, pp. 36-41; 3, pp. 70-76; 4, pp. 118-128; 5-6, pp. 156-166; 7, pp. 212-221; 8, pp. 264-270; 9, pp. 301-307; 10, pp. 328-334, pls. 2*).

On the germination of some æcidial spores, P. NYPELS (*Ann. Soc. Belge Micros., 22 (1898), No. 2, pp. 103-111, fig. 1*).—Notes are given on the germination of the spores of *Æcidium leucospermum* and some other forms.

Vegetable physiology, G. BERTHOLD (*Untersuchungen zur Physiologie der pflanzlichen Organisation. Leipzig: Wilhelm Engelmann, 1898, pt. 1, pp. IV + 243, pl. 1*).

Reaction of protoplasm to thermal irritation, K. L. SCHAEFER (*Flora, 85 (1898), pp. 135-140*).—It is stated that between 10 and 31° C. sensitiveness increases nearly in a geometrical ratio proportional to the arithmetical increase in temperature.

Light and vegetation, D. T. MACDOUGAL (*Pop. Sci. Mo., 54 (1898), No. 22, pp. 193-201*).—A popular paper in which is shown the influence of light on growth of plants.

A remarkable increase in the size of leaves apparently due to reduction of light, W. J. BEAL (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 414*).—Shortly before flowering several plants of *Kalmia angustifolia* were removed from Grayling, Michigan, to the grounds of the Michigan Agricultural College, where they were planted in wet muck, and over the tops about 8 ft. above was a screen of lath and leaves of trees, which cut off at least one-half of the light during the middle of the day and a larger percentage morning and evening. The leaves of these plants were much larger than normal, the surface being fully four times that of leaves from the original habitat collected the year previous.

On seasonal variations of elevation in a branch of a horse chestnut, M. CHRISTY (*Jour. Linn. Soc. Bot. [London], 33 (1898), No. 234, pp. 501-506, pl. 1*).—Notes a seasonal variation in the elevation of a limb of a horse-chestnut tree. Observations covering nearly 4 years are reported in which there seemed to be an almost regular depression and elevation of the limb.

Metals in plants, A. CHARLIER (*Jour. Hyg., 23 (1898), No. 1154, pp. 523, 524*).

Function of calcium salts, O. LOEW (*Bot. Centbl., 74 (1898), No. 8, pp. 202–205; 9–10, pp. 257–265; abs. in Jour. Roy. Micros. Soc. [London], 1898, No. 5, p. 558*).—Although calcium may be necessary to higher plants, it is not for certain fungi and algæ. It is claimed that the nucleus and chlorophyll bodies, except in their earliest states, utilize calcium in forming protein compounds. The salts of strontium have no injurious action if the plant is supplied with sufficient calcium. Fungi differ in their ability to substitute rubidium for calcium.

Concerning the origin and transformation of lecithin in plants, J. STOKLASA (*Ztschr. Physiol. Chem., 25 (1898), No. 5–6, pp. 398–405*).—This paper treats of the exchange of lecithin and proteids in plants in the dark and lecithin formation in leaves and chlorophyll free cells.

Water movement in trees, P. WAGNER (*Natur., 47 (1898), No. 39, pp. 463, 464*).

On the growth of rhizomes, A. RIMBACH (*Beitr. Wiss. Bot., 3 (1898), No. 1, pp. 177–204, figs. 10*).

Contractile roots and their activity, A. RIMBACH (*Beitr. Wiss. Bot., 2 (1897), No. 1, pp. 1–28, pls. 2*).

Some particular organs from the root of Hedysarum coronarium in relation to Bacillus radicicola and Phytomyxa leguminosarum, G. MOTTAREALE (*Atti R. Inst. Incorag. Naples, 4. ser., 11 (1898), No. 4, pp. 7*).

Nitragin, A. P. AITKEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 188–195*).—The author gives a popular review of the subject of assimilation of atmospheric nitrogen by bacteria and calls attention to the use of pure cultures of *Bacillus radicicola*, which is supplied to the trade under the name of Nitragin. The preparation and use of this pure culture have already been referred to in this publication (E. S. R., 7, p. 906).

Low temperatures for physiological experimentation, H. B. HUMPHREY (*Jour. Appl. Micros., 1 (1898), No. 11, pp. 192, 193*).—Describes simple methods for securing low temperatures for physiological experiments.

Concerning the pathogenesis of saprophytic micro-organisms, H. VINCENT (*Ann. Inst. Pasteur, 12 (1898), No. 12, pp. 785–798*).

Variation in the lower fungi due to medium, M. J. RAY (*Variations de champignons inférieurs sous l'influence du milieu. Lille: Le Bigot Frères, 1898; abs. in Jour. Hyg., 23 (1898), No. 1156, pp. 550, 551*).

Plant forms arising through bud variation, L. BEISSNER (*Sitzber. Niederrhein. Gesell. Bonn: 1898, p. 13*).

METEOROLOGY—CLIMATOLOGY.

Report on the work of the station of agricultural climatology at Juvisy during 1897, C. FLAMMARION (*Bul. Min. Agr. [France], 17 (1898), No. 4, pp. 775–811, figs. 16*).—The work of the year, which was largely a continuation of the work of previous years (E. S. R., 8, p. 26; 10, p. 103), included investigations and observations on the relation of the sun to nature, solar rays and the growth of plants, effect of different rays of light on the color of plants, temperature of the air and soil, photography of clouds, solar radiation, rainfall, underground water, and miscellaneous experiments on plants.

Under the head of the relation of the sun to nature, the author records phenological observations at Paris and at Juvisy, including a record of the time of leafing and flowering of chestnut trees during a series of years and the return of migratory birds. An attempt is made to trace a relation between these recurrent phenomena and the activity of the

sun as indicated by the extent of sun spots on its surface. From the data thus secured the author concludes that the sun sends more heat to the earth during those periods when sun spots are most numerous, and that during such periods the seasons are more advanced and the growth of plants more vigorous.

The author continued during 1897 his experiments of previous years on the influence of different rays of the sun on the growth of plants, the principal modification of the previous experiments being the growing of plants of different kinds under light of varying intensity. As a rule the results in these experiments with sensitive plants, strobilanthus, coleus, grapes, corn, cosmos, salvia, etc., confirm those of the previous experiments. In order to determine whether plants which naturally grow best in a subdued light would give different results, experiments were made with ferns, but these behaved in every respect like the other plants experimented with. The principal results obtained in these experiments are summarized in the following table:

Growth of plants in different colored light.

	Sensitive plants.	Coleus *a*.	Coleus *b*.	Salvia.	Cosmos.	Spiræ.	Strobilanthus.	Cabbage.
	Cm.	*Cm.*	*Cm.*	*Cm.*	*Cm.*	*Cm.*	*Cm.*	*Cm.*
Height June 15:								
Red light	2.5	12.0	18.0	30.5	30.0	3.5	12.0	5.0
White light	2.5	12.0	15.0	30.0	30.0	3.0	12.0	5.0
Green light	2.5	12.0	18.0	30.5	30.0	3.0	14.0	5.0
Blue light	2.5	12.0	22.0	30.0	30.0	3.0	13.0	5.0
Height July 23:								
Red light	16.0	40.0	50.0	85.0	80.0	20.0	27.0	10.0
White light	6.0	30.0	30.0	70.0	70.0	14.0	19.0	6.0
Green light	4.0	18.0	18.0	38.0	50.0	3.0	16.0	5.0
Blue light	2.5	14.0	24.0	30.0	30.0	3.0	14.0	5.0
Height August 25:								
Red light	22.0	65.0	70.0	150.0	150.0	50.0	55.0	....
White light	8.0	40.0	32.0	150.0	150.0	40.0	25.0	....
Green light	6.0	20.0	24.0	60.0	60.0	12.0	28.0	....
Blue light	2.5	18.0	24.0	30.0	30.0	10.0	17.0	....
Maximum growth:								
Red light	19.5	53.0	52.0	119.5	12.0	46.5	43.0	5.0
White light	5.5	28.0	17.0	129.5	12.0	37.0	13.0	1.0
Green light	3.5	8.0	6.0	29.5	30.0	9.0	14.0	0.0
Blue light	0.0	4.0	2.0	0.0	0.0	7.0	4.0	0.0

This table shows that as a rule the greatest growth was made in the red light.

The results of experiments with sensitive plants grown in light of different degrees of intensity showed that a slightly diffused light was the most favorable. With strobilanthus and coleus intensities of 65 and 50 per cent, respectively, were most favorable to the growth of the vegetative organs. The behavior in this respect differed widely with the species of plant under trial. It is hoped by further experiments to classify plants with reference to their sensitiveness to the action of light, and thus to determine those plants which will be profitably benefited by shading. For shading plants the author recommends a cloth of loose texture. This not only insures the diffused light most favorable to the growth of many plants, but affords a protection against

cold and excessive heat and retards the evaporation of moisture from the soil.

Experiments on the influence of different solar rays on the color of plants were continued with the same plants experimented with in previous years (E. S. R., 10, p. 112), and with other species in addition. It was found that the different colored rays had different effects, both on the coloration of the plants and on the odor. As a rule plants grown in red light were much more fragrant than those grown in other colored rays. This was quite marked in the case of crassula, which when grown in the open air was almost without fragrance, but when grown in red light developed a delicate perfume resembling that of the banana or amyl acetate.

Studies of the coloration of the different plants indicated that this is almost always a chemical phenomenon. The coloring matter of the plants was extracted with alcohol and the solution tested with hydrochloric acid, ammonia, alum, etc. The results obtained are given in the following table:

The colors of different flowers and their behavior with chemical reagents.

	Color of flowers—		Color of untreated alcoholic solution.	Color of alcoholic solution treated—		
	At beginning of blooming.	At end of blooming.		With hydrochloric acid.	With ammonia.	With alum.
Mallow	Rose	Pale blue	Rose	Deep rose	Greenish yellow	Mauve.
Rose geranium	do	Red	do	do	do	
Verbena	Red	White	Pale rose	Orange red	Green	Pale yellow.
Hydrangea	Green	Rose	Rose	Red	do	Blue.
Crassula	White	Red	Red	do	Greenish yellow	Mauve.

The author concludes that the action of light on the plant sets free a certain amount of acid which acts on the leucites, producing a red coloration. An illustration of the possibility of modifying the color of plants is afforded by the case of hydrangea, the flowers of which are greenish yellow when they first appear and become rose colored under the action of light. In order to obtain blue hydrangea flowers gardeners are accustomed to water the plants with a solution of alum. It is very probable that the double sulphate of aluminum and potassium neutralizes the acid and converts the red color into blue.

A record is given of the temperatures recorded by a standard thermometer and by maximum and minimum thermometers. These data are discussed at some length.

The author concludes that there is no relation between the phases of the moon and the character of the weather.

In pursuance of a systematic plan for studying the relation between clouds and various atmospheric phenomena the author has made a series of cloud photographs, the method pursued in this work being described at some length.

A series of observations on the temperature of bare and sod land at the surface and at depths of from 0.05 to 1 meter are recorded. The curves of temperature show fluctuations identical in kind but varying in degree for the two kinds of soil. The variations are especially noticeable in the upper layers of soil, the sod land being warmer in winter and colder in summer than the bare soil.

A record is given of observations on solar radiation with a new form of actinometer. This instrument consists of a dark blue spherical glass reservoir containing ethyl alcohol into which extends the tapering point of a graduated tube, the upper portion of which carries a bulb. When this apparatus is exposed to the sun the reservoir is heated and the alcohol distils over into the graduated tube where it can be measured. This furnishes a basis for the calculation of the calorific power of the sun. Various improvements in the details of this apparatus and corrections which must be applied to the results obtained with it are noted. A diagram is given which compares the theoretical and actual hours of sunshine at Juvisy.

Observations on rainfall during the year are reported and the results are compared with similar observations for a long period of years. Observations on cloudiness are also reported in this connection. The rainfall observations show that precipitation has gradually increased at Paris since 1733.

As in previous years observations were made on the temperature of the water in 2 wells 13.56 and 14.08 meters deep, respectively. The temperature in the former was 11.5° C., and in the latter 11.1°.

By keeping oak trees in a uniform temperature throughout the year the author succeeded in causing the production of new leaves before the shedding of the old ones.

Meteorological observations, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1897, pp. 252–254*).—This is a monthly summary of observations at the station during 1897 on atmospheric pressure, temperature, precipitation, cloudiness, and wind movement, and on rainfall at 21 different places in the State during May to October. The mean pressure during the year was 30.05 in.; the mean temperature, 47° F.; the precipitation, 53.03 in.; number of rainy days 116, fair days 130, cloudy days 125; total movement of wind, 76,634 miles. The length of the growing season (from the last killing frost in spring to the first in autumn) was 159 days. The meteorological conditions of the season were about normal, except in the case of precipitation, which was considerably above the average for the State (48.5 in.).

The causes of rain, J. R. PLUMANDON (*Pop. Sci. Mo., 54 (1898), No. 1, pp. 89–96*).—This is a translation from *Ciel et Terre* in which the influence of variations in temperature and moisture and the presence of dust on the production of rain is discussed.

Sunshine and cloudiness in Nebraska, G. D. SWEZEY (*Rpt. Nebraska State Hort. Soc., 27 (1896), pp. 45–47, figs. 2*).—A brief summary of observations with a description of an electrical sunshine recorder.

Report of the meteorologist, J. E. OSTRANDER (*Massachusetts Hatch Sta. Rpt. 1897, pp. 45, 46*).—A brief statement of the work of the year in the meteorological department of the station.

Meteorology, P. BÔNAME (*Rap. Ann. Sta. Agron.* [*Mauritius*], (*1897*), *pp. 1–7*).—A record is given of observations on atmospheric pressure, temperature, and precipitation during the year 1897.

The meteorology of 1896 (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 363–371*).—Notes on the weather, summaries of observations of atmospheric pressure, temperature, sunshine, etc., during each month, with departures from normals. The influence of the season upon the character of the crops of wheat, barley, oats, potatoes, and turnips, is also noted.

Results of meteorological observations, 1894–95 (*Ergebnisse der meteorologischen Beobachtungen im Jahre 1894–95. 14–15 Ber. meteorologische commission. Naturf. Ver. Brünn. 1896–97.*

Meteorology, J. E. BONEBRIGHT (*Idaho Sta. Bul. 13, pp. 76–88*).—Monthly and yearly summaries are given of the records at Moscow for 1894, 1895, 1896, and 1897; at Grangeville for 1894, 1895, and 1896; and at Nampa for 1894, 1895, and 1897. Observations are recorded on temperature, precipitation, atmospheric pressure, cloudiness, dates of first and last killing frosts, and relative humidity and mean dew-point of the growing season.

WATER—SOILS.

The conservation of soil moisture and economy in the use of irrigation water, E. W. HILGARD (*California Sta. Bul. 121, pp. 12, pls. 3, fig. 1*).—Reference is made in this bulletin to a series of soil moisture determinations which the station has undertaken with a view to utilizing "the present unusual season [1898] for the study of the limits of endurance of drought on the part of the several crop plants and with it to determine the minimum of water that will suffice for their satisfactory growth in the several soils." This work is not yet completed, but has already given some valuable results.

It has been shown that plants send down their roots to a much greater depth in the deep uniform soils of the arid region than is usual in the soils of humid regions. This is believed to be the main cause of the remarkable resistance to drought shown by plants in these regions. The author discusses the advantages of so applying the irrigation water and fertilizing that plants will be encouraged to send their roots into the depths of the soil, and of so cultivating the soil that its storage capacity will be increased and evaporation decreased.

Some of the more important conclusions are, in brief, as follows:

"The most economical mode of using irrigation water is to put it 'where it will do the most good,' close to the stem of the plant or trunk of the tree, and let it soak downward so as to form a moist path for the roots to follow to the greatest possible depth. . . . Fall plowing wherever the land is not naturally adequately absorbent and is not thereby rendered liable to washing away is a very effectual mode of utilizing the winter's moisture to the utmost. . . . Moistening the ground to a considerable depth by winter irrigation is a very effective mode of promoting deep rooting, and will thus stand in lieu of later irrigations, which, being more scant, tend to keep the roots near the surface. . . . It can not be too strongly insisted upon that in our arid climate farmers should make themselves most thoroughly acquainted

with their subsoil down to a depth of at least 4, but preferably 6 or 8 ft. . . . Similarly, no irrigator should be ignorant of the time or amount of water it takes to wet his soil to a certain depth. . . . A definite knowledge of the rapidity with which irrigation water penetrates downward and sideways in his soil should form a part of the mental equipment of every irrigator, particularly in arranging his head ditches. . . . Supposing the moisture to have reached the depths of the soil, whether from rains or from irrigation, it is essential that proper means be employed for retaining it in the land, and especially to prevent evaporation. That this is best accomplished by a mulch on the surface, and that the best mulch for the purpose, which need not be hauled on or off and is always ready, is a surface layer of loose, well-tilled soil, is now pretty well understood by all. . . . In the East, where this principle is well understood, it is considered that a surface layer 3 in. in thickness is sufficient to afford effective protection. But what is adequate in the region of summer rains is quite insufficient in California and in the arid region generally. It takes fully twice the thickness mentioned, and preferably more, to afford protection against the drought and heat lasting 5 or 6 months at a stretch."

Determinations of moisture in the soil of apricot orchards lying side by side, one cultivated and giving a good crop of fruit and growth of wood and the other uncultivated and producing poor fruit and little growth of wood, showed 244 lbs. more water per acre to a depth of 6 ft. in the former than in the latter in July.

Measurements of soil temperatures at Norwegian observation stations, 1892–1897, J. SEBELIEN (*Tidsskr. Norske Landbr., 5 (1898), No. 7, pp. 295–318*).—The observations here recorded and discussed were begun in 1892. A report of the first year's work at Aas and Jönsberg has already been noted (E. S. R., 6, p. 199). The stations at Rotvold and Bodö (the former near Drontheim, both in Northern Norway) were added in 1895. The soil at Aas and Rotvold is clayey, at Bodö sandy, and at Jönsberg, black pulverized alum slate. Observations were taken at depths of 0.25, 0.5, and 1 meter, and (in case of Aas since July, 1895) at 1.5 meters. The observations at Aas Agricultural College are particularly complete and instructive, covering a period of 5 years.

Mechanical and partial chemical analyses of the soil at the various depths are given in case of each station, and the bearing of the results on the temperature of the soil are discussed at some length.—F. W. WOLL.

Observations on the management of sewage farms, O. PFEIFFER (*Chem. Ztg., 22 (1898), No. 56, p. 560*).—A brief discussion of the amount of fertilizing constituents absorbed from sewage by soils and the amount escaping in the drainage water, based mainly upon observations made on the sewage fields of Magdeburg. It was found that the potash was largely and the phosphoric acid completely absorbed. The drainage water, however, contained a large amount of nitrates and little organic nitrogen, thus indicating quite complete nitrification and showing the danger of loss of considerable amounts of nitrogen when the ground is not covered with crops to utilize the nitrates.

Nitric nitrogen produced by the pea, J. L. BEESON (*Jour. Amer. Chem. Soc., 20 (1898), No. 10, pp. 793–795*).—Small plats of very fertile

bottom land of uniform character were planted in peas, peas and corn, corn, cotton, and sorghum, and one plat was cultivated like the others but kept free from vegetation. Determinations of nitric nitrogen in the soil of the different plats were made September 30, after about 6 weeks of dry weather, by the following method: "One kilogram of soil was taken about 1 ft. from the plants, in several places, but toward the center of each plat. It was shaken for 6 hours with 1 liter of water, the suspended clay precipitated with 5 gm. of sodium chlorid, one-half liter decanted, evaporated to small bulk, and the nitric nitrogen estimated in duplicate by the Tiemann and Schulze method."

The number of milligrams of nitric nitrogen in 1 kg. of soil is given for each plat below:

Nitric nitrogen in 1 kilogram of soil.

	Mgms.
Fallow plat	1.010
Plat planted in peas, growing, pods nearly grown	3.333
Plat planted in peas, growing, pods about ripe	8.670
Plat planted in peas, grown and dead about two or three weeks	10.510
Plat planted in corn (hard), peas same as above	7.503
Plat planted in corn (hard)	.340
Plat planted in cotton, growing	.423
Plat planted in sorghum, growing	.333

The data show a much greater accumulation of nitrates in the soil under leguminous plants than in the bare soil or that under corn, cotton, or sorghum. The results indicate "that the micro-organisms of the pea roots assimilate more nitrogen than the plant needs for its growth." If this be true, "peas planted with a crop would tend to increase the yield of that crop, unless the peas be so thick as to interfere with the crop's root development, or use up too much water in their growth."

On denitrification, G. AMPOLA and C. ULPIANA (*Gaz. Chim. Ital., 28 (1898), No. 410; abs. in Chem. Ztg., 22 (1898), No. 85, p. 264*).—The authors isolated from soil a denitrifying organism which differs in character from the *Bacterium denitrificans agilis* of Ampola and Garino, as well as from those of Burri and Stutzer, and Schirokikh. This organism grows well both in presence and absence of air. The name *B. denitrificans* V has been adopted by the authors for this organism, and its behavior in different media is described. The second organism was isolated from a nitrate solution which had been exposed to the air in the laboratory for some time and was undergoing decomposition with the escape of nitrogen. To this organism the authors give the name *B. denitrificans* VI. The conditions most favorable to the development of both of the organisms are a 0.3 per cent nitrate solution, and a temperature between 30 and 40° C. Sunlight has no effect upon them. In pure distilled water the organisms are capable of surviving for 7 months. When dried, *B. denitrificans* V died within 8 weeks, and *B. denitrificans* VI was alive and active at the end of 5 months.

The mechanical composition of wind deposits, J. A. UDDEN (*Augustana Libr. Pubs., No. 1, pp. 69*).—This is a contribution to this subject from the Augustana College and Theological Seminary at Rock Island, Illinois.

"Samples of different kinds of materials moved by the wind have been collected from different places of deposition [including points in Massachusetts, Illinois, Indiana, Kansas, Nebraska, and North Dakota], and from the atmosphere directly for this study. Each of these has been separated into grades of different coarseness and the percentage of the weight for each grade in each sample has been determined. It appears that all of these samples, and presumably the greater part of such materials as owe their present position and arrangement to the action of the atmosphere, may be referred to some one of four categories. These may be characterized as (1) lag gravels, or coarse residual deposits in the rear of sand dunes; (2) drifting sand, constituting the familiar dunes in dry and sandy regions; (3) fine sand, which is soon dropped by the wind in the lee of drifting dunes; and (4) dust, which only slowly settles out of the air far away from the place where it was raised.

"Numerous observations on known eolian deposits in the field and on the mode of action of the wind have also been made to supplement this special study of the mechanical composition of wind sediments, and these are drawn upon in the discussion of the other data."

Observations on soil moisture, R. A. EMERSON (*Rpt. Nebraska State Hort. Soc., 27 (1896), pp. 179–185, figs. 4*).—This article records observations on cultivated v. seeded orchards; garden soil cultivated, uncultivated, mulched, in grass; mulched v. cultivated soil in potatoes; fall-plowed, spring-plowed, and unplowed soil; and windbreaks of forest trees and hedges.

On certain soils rich in potash, A. BORNTRAEGER and G. PARIS (*Landw. Vers. Stat., 50 (1898), No. 5–6, pp. 343–345*).—This article briefly summarizes the investigations of Casoria[1] on the solubility of potash of soils of volcanic origin in acetic acid, hydrochloric acid (1.12 sp. gr.), and hydrofluoric acid applied successively; and reports results of analyses by the authors of the hydrochloric acid extract (boiling 1.12 sp. gr. with acid for 5 hours) of 4 soils of volcanic origin (from the vicinity of Vesuvius). The potash soluble in hydrochloric acid ranged from 2.71 to 5.05 per cent.

Soil bacteria which liberate nitrogen, CARON (*Die Stickstoffbildenden Bodenbakterien. Hannover: Gohmann'sche Buchdruckerei, 1897*).—Such organisms are stated to be most abundant in fallow land, less abundant under leafy plants, and least abundant under cereals.

The denitrification processes, T. PFEIFFER and O. LEMMERMANN (*Landw. Vers. Stat., 50 (1898), No. 1–2, pp. 115–142*).—This is a detailed account of investigations already noted (E. S. R., 9, p. 536).

FERTILIZERS.

Experiments with ferrous sulphate for destroying the denitrifying organisms of barnyard manure and the germs of Rothlauf and Schweineseuche, O. MÜLLER (*Jour. Landw., 46 (1898), No. 2, pp. 207–232*).—In culture experiments with *Bacterium denitrificans*, *B. pyocyaneus*, and *B. fluorescens liquefaciens* in bouillon containing 0.1 per cent of nitrate, ferrous sulphate was used in the form of powder at rates of from 0.2 to 5 per cent. The results show that the addition of 1 gm. of the powdered sulphate to each 10 gm. of the slightly alkaline culture solution killed all of the germs in 24 hours. In neutral solutions a smaller quantity was effective.

Two series of experiments were carried out with the same prepara-

[1] Riv. Ital. Sci. Nat., 1 (1885), No. 1. Idrol. e Climat. Med., 7 (1885), No. 9; 9 (1887), No. 3; 11 (1889), No. 8. An. R. Scuola Sup. Agr. Portici, 4 (1884), No. 1; 5 (1885), No. 1.

tion on horse manure. In one series the manure contained from 80 to 82 per cent of moisture, in the other from 65 to 68 per cent. To each 100 gm. of the manure well supplied with denitrifying organisms from 5 to 25 gm. of the powdered sulphate was added, the powder being intimately mixed with the manure. From time to time nitrate bouillon was inoculated with particles of the manure. The culture experiments indicated that in order to destroy the denitrifying organisms it was necessary to mix at least 5 per cent of the powdered sulphate with the manure, provided the manure contained at least 65 to 70 per cent of moisture. When the amount of sulphate was increased to 20 to 25 per cent all organisms in the manure were killed. As a rule the sulphate was more effective in moist than in dry manure.

Another series of experiments was carried out with moist (80 per cent of water) and dry (65 to 68 per cent of water) manure in layers 1, 2, and 4 cm. thick, the sulphate being spread over the surface of the manure in layers from 1 to 2 mm. thick. The time required for the powder to be absorbed by the manure and for the organisms to be killed depended upon the thickness of the layer of the manure and the amount of moisture present. In the thin layers the organisms were completely destroyed in 24 hours, while in the thick dry layers they were still active at the end of 12 days. It appeared that in the case of the moist manure 10 per cent of the powdered sulphate was sufficient to insure complete destruction of the denitrifying organisms, while in the case of the dry manure 15 per cent was necessary.

In a third series of experiments 100 gm. portions of manure were treated with 2.5, 5, and 10 per cent solutions of the preservative. In this case 40 gm. of 5 per cent solution (2 gm. of the sulphate) was sufficient to destroy the organisms in 100 gm. of manure both in the dry and moist condition.

Culture experiments similar to those with the denitrifying organisms were made with the germs of Rothlauf and Schweineseuche. These experiments indicated that 0.44 to 0.5 per cent of the sulphate was sufficient to kill these organisms.

Two sprinklings with a 5 per cent solution of sulphate is believed to be the most practicable and effective means of destroying both denitrifying organisms and disease germs in manure.

An analysis of the sulphate used is given which shows that it contained 66.18 per cent of ferrous sulphate, 5.4 per cent of free sulphuric acid (SO_3), 5.3 per cent of ferric sulphate, and 1.32 per cent of water and insoluble residue.

On denitrifying organisms, O. KÜNNEMANN (*Landw. Vers. Stat., 50 (1898), No. 1–2 pp. 65–113*).—The author reviews the literature of the subject, and reports in detail experiments in preparing pure cultures of denitrifying organisms from horse and cattle manure, from straw, and from different kinds of soils. The organisms isolated are described, and their behavior in different culture media and in the presence of

varying amounts of oxygen (air), nitrate, caustic lime, and sulphuric acid is discussed.

It was found that horse manure as a rule contains denitrifying organisms and these are usually of two kinds, one of them being also found in straw. The organism found only in the manure reduces nitrates in symbiosis with *Bacterium coli* and is identical with *Bacillus denitrificans* I of Burri and Stutzer. The organism found both in the manure and in straw is considered a variety of the *Bacillus denitrificans* II isolated from straw by Burri and Stutzer.

Denitrifying organisms are not present as a rule in cattle manure. Those obtained from this source were identical with *Bacillus denitrificans* I of Burri and Stutzer.

The reduction of nitrates due to the action of these organisms is considerable, but decreases with the amount of organic matter in the culture medium. *Bacillus denitrificans* I (in symbiosis with *Bacterium coli*) completely reduced the nitrate in nutrient bouillon containing as much as 0.7 per cent of that substance. *Bacillus denitrificans* II did the same in bouillon containing as high as 0.8 per cent of nitrate.

The exclusion of air as well as its free admission checked the denitrifying action of *Bacillus denitrificans* I, but were without effect upon the action of *Bacillus denitrificans* II.

Sulphuric acid is extremely active in preventing denitrification, 0.17 per cent in the culture medium being sufficient to prevent the development of the denitrifying organisms.

Denitrifying organisms are less frequently present in cultivated soils than in manure and are usually of a different kind. The denitrifying organisms isolated from soils were *Bacillus pyocyaneus*, *B. fluorescens liquefaciens*, and *B. denitrificans* III, an organism not previously described. These organisms reduce nitrates as actively as those present in manure. As in the case of the latter, the presence of sulphuric acid to the extent of 0.17 per cent completely checked the activity of the soil organisms.

Comparison of different phosphates, W. P. Brooks (*Massachusetts Hatch Sta. Rpt. 1897, pp. 16–19*).—This is an account of experiments during 1897 on 13 eighth-acre plats planted to corn. The whole area had received an application of 600 lbs. of ground bone and 200 lbs. of muriate of potash per acre in 1896, before the laying out of the plats. In 1897 each of the plats received a basal fertilizer of potash-magnesia sulphate 50 lbs., nitrate of soda 30¼ lbs., and sulphate of potash 12½ lbs. per plat. In addition to this basal fertilizer the different plats received phosphoric acid in the form of hoof meal, bone meal, dissolved boneblack, acid phosphate, Navassa phosphate, South Carolina rock phosphate, Florida soft phosphate, apatite, and basic slag.

"[The results show] that the yield on the plats to which phosphates were applied varied without apparent relation to the availability of the phosphoric acid in the materials used. . . . The unfavorable influence of the season and possible differences in natural fertility of the soil serve to obscure the action of the phosphates employed."

Analyses of commercial fertilizers, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Buls. 63, pp. 47–60; 64, pp. 63–76; 65, pp. 79–124*).—These bulletins report analyses and valuations of 126 brands of fertilizers inspected during the spring of 1898, with notes on valuation and a discussion of the results of inspection.

"Three-quarters of the total number [of fertilizers inspected] were above guarantee in every respect, nine-tenths were essentially equal to or better than guarantee, and all afforded the commercial equivalent of their guarantees. Thirteen brands fell short more than 0.20 per cent in one ingredient, and two were lacking in two ingredients. In neither case were both ingredients seriously deficient.

"The application of pepsin digestion and alkaline-permanganate distillation methods to the several brands indicated that the quality of the organic nitrogen of about a dozen brands, notably the output of two concerns, was somewhat questionable.

"One hundred and five brands were guaranteed (directly or inferentially) to contain potash as sulphate, a claim which was verified in but 19 cases.

"The average valuation was found to be $17.45 and the average selling price $29.04. Two dollars out of every five invested in fertilizers paid for costs of manufacture and sale. A dollar spent for average low-priced goods (below $28) bought 58 cts. worth of plant food; a dollar invested in average medium grade-brands ($28 to $32), 60 cts. worth; and a dollar paid out for average high-priced goods ($32.50 and upwards), 67 cts. worth. A dollar bought 79 cts. worth of plant food in one brand and but 39 cts. worth in another. A fifth of the entire number of brands sold furnished less than 55 cts. worth of plant food for a dollar.

"The average composition of the goods has not varied materially from that of last year. Selling prices are the same, plant food in mixed goods is as cheap as it ever was, but owing to the low prices of raw materials the practice of home-mixing is proportionately more profitable now than hitherto.

"Home-mixtures made in this State furnished from 30 to 50 per cent more plant food at the same cost than did average manufacturers' mixtures."

Report of the chemist. Department of fertilizers and fertilizer materials, C. A. GOESSMANN ET AL. (*Massachusetts Hatch Sta. Rpt. 1897, pp. 106–127*).—A brief summary is given of the work during 1897, including statements regarding the inspection of fertilizers and analyses of barnyard manure, wood ashes, cotton-seed meal, Damara Land guano, crematory ashes, and wool washings, with brief notes on their value as fertilizers.

Fertilizing value and statistics of production, imports and exports of oil cakes of France, MAIZIÈRES (*L'Engrais, 13 (1898), No. 52, pp. 1235–1237*).

Manure pits and cisterns, M. RINGELMANN (*Jour. Agr. Prat., 62 (1898), II, No. 46, pp. 707–712, figs. 7; 50, pp. 856–860, figs. 6*).—A variety of pits and cisterns are described and figured.

The turning under of straw, stubble, etc., P. BONAME (*Rap. Ann. Sta. Agron. [Mauritius], 1897, pp. 55–57*).—The merits of this practice are discussed, the conclusion being drawn that, although it has some disadvantages, the benefits resulting from it in the improvement of the soil more than counterbalance these objections. Comparative tests of burning and turning under were made on sugar cane with results decidedly favoring the latter practice.

Fertilizer experiments with potash salts (*L'Engrais, 13 (1898), No. 52, pp. 1241, 1242*).—An account is given of experiments with wheat on calcareous, clayey-calcareous, and sandy soils, which indicate that in every case applications of potash were profitable when they did not exceed 150 kg. of chlorid or sulphate per hectare.

Nitrate of soda and the exhaustion of the soil, L. GRANDEAU (*Jour. Agr. Prat., 62 (1898), II, No. 40, pp. 485–487*).—A popular article.

The nitrate of soda industry, MAIZIÈRES (*L'Engrais, 13 (1898), No. 40, pp. 947, 948*).

Fields for experiment and demonstration, MAIZIÈRES (*L'Engrais, 13 (1898), No. 42, pp. 996, 997*).—A popular article, based largely on the work of Grandeau, Weitz,

and Steiger, recommending field tests for determining the fertilizer requirements of soils and describing methods of conducting such tests.

Analyses of commercial fertilizers (*South Carolina Sta. Bul. 35, pp. 32*).—This bulletin gives notes on valuation of fertilizers in South Carolina and laws and regulations controlling fertilizer inspection in that State, with tabulated analyses and valuations of 142 samples of fertilizing materials inspected during the season of 1897–98.

Natural phosphates compared with each other and with acid phosphate, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1897, pp. 14–16*)—This is a continuation of experiments begun in 1890 (E. S. R., 9, p. 337). The crop grown during 1897 was Swedish turnips. The peculiarities of the season rendered the results of the experiment inconclusive.

FIELD CROPS.

Composition of maize, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Bul. 50, pp. 31*).—This bulletin, which is compiled chiefly from the records of the Division of Chemistry, treats of the composition of Indian corn, the composition and properties of the stalks, composition of cobs, manufacture of starch, glucose, whiskey, and alcohol, and the by-products obtained in their manufacture.

The composition of maize, as shown by analyses in the United States and other countries, is discussed at length. Many analyses are quoted.

"A study of all the analyses which have been made in this division reveals the fact that maize is one of the most invariable of the cereals, maintaining under the most different climatic conditions a most remarkable uniformity of composition, and varying chiefly in the size, color, and general physical characteristics of its kernels rather than in their composition."

The fact that, as shown by analyses, American maize contains less water than European maize is also pointed out.

The high nutritive value of maize meal is insisted upon. The different processes of milling are described. Indian-corn flour is discussed at some length. In milling, the outer envelope and germ are removed. This flour has the following percentage composition: Moisture 12.57 per cent, proteids 7.13 per cent, ether extracts 1.33 per cent, carbohydrates 78.36 per cent, crude fiber 0.87 per cent, and ash 0.61 per cent. The heat of combustion as calculated is 3,836.8 calories per pound, and as determined 3,888.3 calories.

An extended study of the composition and properties of cornstalks is reported. It was found that the nodes formed 26.08 per cent of the stalk, the pith of the internodes 20.25 per cent, and the shells of the internodes 53.67 per cent. The composition of the three portions was as follows:

Analysis of stalks of maize.

Constituents.	Nodes.	Pith of internodes.	Shells of internodes.
	Per cent.	*Per cent.*	*Per cent.*
Moisture	6.52	7.01	4.95
Protein	4.38	3.50	2.44
Fat	.94	1.17	.78
Carbohydrates other than crude fiber	48.21	44.08	43.88
Crude fiber	37.94	41.44	46.01
Ash	2.11	2.80	1.94

The solubility of the different portions of the stalk in acid and alkali alone and successively was studied, as well as the furfurol content of the samples.

"The composition of the samples, as determined by successive digestion with acid and alkali, and determination of the other ingredients on a water-free basis, is shown by the following table:

Composition of pith and internodes of stalks of maize.

Division of stalk.	Proteids.	Fat.	Insoluble carbohydrates.	Soluble carbohydrates.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Nodes	4.69	1.01	33.81	58.23	2.26
Pith from internodes	3.76	1.26	35.64	56.33	3.01
Shells from internodes	2.57	.82	39.43	44.86	2.04

"These data show that if the matters are treated with both alkali and acid in preparing them for paper pulp they will yield of that material only about one-third of their weight. On the other hand, when treated by an alkali or acid alone they will yield about one-half of their weight as paper pulp."

The kinds and quantities of sugar obtained from the different portions of the stalk by hydrolysis were determined, and also the celluloses as separated by the chlorination process. The results of the study of the stalks was summarized as follows:

"Summing up the results of the investigations, it is seen that the material examined consists of several different kinds of matter. It contains a small quantity of mineral matter, of ash, of proteid matter, and of matter soluble in ether, but is chiefly composed of carbohydrate material. This material is of various kinds. A part of it will yield by hydrolysis with an acid a small quantity of dextrose capable of fermentation. A larger part, on hydrolysis, is converted into a pentose sugar, presumably xylose, incapable of fermentation, but capable of reducing an alkaline copper solution. Another quantity, perhaps larger than that just mentioned, passes into solution under the influence of hydrolyzing agents, but does not seem to produce a sugar capable of reducing alkaline copper solution. The largest portion of carbohydrate matter consists of cellulose of 2 varieties, which may be designated as α and β. Both of these celluloses are insoluble in chlorin, but the β cellulose may be dissolved in dilute nitric acid. The bodies which are capable of yielding furfurol consist largely of xylan and allied pentosan substances. There is, however, as the data have shown, a considerable quantity of matter present capable of yielding furfurol on distillation with hydrochloric acid, and yet not possessing the properties of pentosan bodies. The character and quantity of this furfurol-yielding complex is not known, and requires further investigation for its separation and study. It is evident that the material could not be profitably employed as a source of ethylic alcohol, as the quantity yielded is not quite 2 per cent in weight of the whole mass. The possibility of obtaining methyl alcohol from this matter by distillation in closed retorts is a subject for further investigation."

Corncobs were found to consist of 1.5 per cent pith and 98.5 per cent shell.

"The pith of the corncob has many of the properties characteristic of that of the stalk; is finer in texture, however, and less absorptive. By experiment it was found that 1 gm. of the air-dry pith absorbs 10.43 gm. of water. The chemical composition of the pith and the shell of the cob are found in the following table."

Chemical composition of corncob.

Constituents.	Pith.	Shell.
	Per cent.	*Per cent.*
Moisture	8.11	9.08
Protein	2.06	1.75
Ether extract	.52	.23
Fiber	34.15	32.17
Ash	2.43	1.55

The properties of the cornstalk pith are discussed at some length, and feeding experiments with animals made at the different stations with corn and with maize and with different parts of the stalk are summarized.

Report of the agriculturist, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1897, pp. 9-14, 19-23, 26-37*).—The results of various field experiments, most of which are in continuation of former work (E. S. R., 9, p. 339), are reported.

Fertilizer and soil tests.—Soil tests were made with corn on 2 farms and with potatoes at the station. One of the tests with corn was ruined by wire and cut worms. The results of the other were as follows:

Soil test with corn.

Fertilizer.	Application per acre.	Increase in yield over unmanured plats. Grain.	Stover.
	Pounds.	*Bushels.*	*Pounds.*
Muriate of potash	160	36.3	2,203
Nitrate of soda	160	8.3	325
Dissolved boneblack	320	15.3	455
Manure	5 cords.	26.4	3,450
Complete fertilizer:			
Nitrate of potash	160	} 52.5	2,455
Nitrate of soda	160		
Dissolved boneblack	320		

In the soil test with potatoes the applications of phosphoric acid, nitrogen, and potash increased the crop on an average 26.6 bu., 11.3 bu., and 7.2 bu. per acre of merchantable tubers, respectively. The application of all 3 elements produced a crop inferior to that where nitrogen and phosphoric acid were applied together. No conclusions are drawn.

The one fourth acre plats used for experiments in manuring corn in previous years (E. S. R., 9, p. 340) were seeded with a mixture of timothy, redtop, and clover without further application of fertilizers. The 2 plats which had received manure alone each season for 6 years yielded on an average 1,403½ lbs. of hay and 784 lbs. of rowen; while the 2 plats which had received manure and potash for the same period gave a yield of 961¼ lbs. of hay and 536½ lbs. of rowen.

Four ¼-acre plats, 2 of which had been fertilized for 6 years with a special corn fertilizer and 2 with a fertilizer richer in potash than the

special fertilizer but furnishing less nitrogen and phosphoric acid (E. S. R., 9, p. 340), were seeded to timothy, redtop, and clover. The plats which had received the special corn fertilizer gave an average yield of 760 lbs. of hay and 113½ lbs. of rowen. The plats which had received the fertilizer richer in potash yielded on an average 713½ lbs. of hay and 147 lbs. of rowen. It is believed that, owing to inequalities of moisture conditions, the influence of the potash was not clearly shown.

The test with legumes was continued from former years (E. S. R., 9, p. 340). A number of plats had received nitrogenous fertilizers while some received no nitrogen. During some seasons legumes were grown on the plats to test their ability as nitrogen gatherers. The results from a crop of oats grown on the plats last season show "not the least evidence of any ability on the part of the soy bean when grown before a grain crop (and harvested) to make nitrogen manuring of the grain crop unnecessary." Of the nitrogen fertilizers, nitrate of soda gave the largest crop, followed by barnyard manure, dried blood, and sulphate of ammonia, in the order given. Double sulphate of potash and magnesia was more effective than muriate of potash, especially when used in connection with sulphate of ammonia. A test of muriate with sulphate of potash in connection with sulphate of ammonia as a corn fertilizer gave too small a difference in yield to ascertain the merits of the two forms of potash.

Experiments with the rotation of manures on grass lands have been continued (E. S. R., 8, p. 402), and the yields for the last season are reported. "This system of using these different manures for grass lands in rotation has much to recommend it."

Nitragin was tried on crimson clover, alfalfa, and common red clover, but without appreciable effect. "The failure of the material to benefit the crop appears to be due to the fact that our soils contain the nodular bacteria of the common leguminous crops in sufficient numbers."

Sulphate of iron used at the rate of 80 lbs. per acre had a very slight effect, sometimes proving deleterious rather than beneficial.

Variety tests.—The results of variety tests with corn, potatoes, grasses, millets, soy beans, and clovers are reported. The 9 varieties of flint and 11 of dent corn tested all proved to be too late for culture except for silage. Of 81 varieties of potatoes, Rose No. 9, Restaurant, Woodbury White, Bliss Triumph, Prolific Rose, Empire State, Early Maine, Dakota Red, Sir William, Early Rose, and Beauty of Hebron gave the best yields, all yielding at the rate of more than 220 bu. of merchantable tubers per acre.

Sixty species and varieties of grasses were tested, most of them occupying plats containing 1 sq. rod. English rye grass, Italian rye grass, crested dog's tail, and meadow fescue winterkilled. Tall oat grass, tall fescue, red fescue, fowl meadow, Canada blue grass, water spear grass, and wood meadow grass are mentioned as promising grasses.

The results for 21 varieties of millets belonging to the species *Panicum crus-galli*, *P. miliaceum*, and *P. italicum*, grown on plats 1 sq. rod in size, are given in a table. Owing to the small size of the plats, no conclusions as to the relative merits of the different varieties are given. Japanese barnyard millet (*P. crus-galli*), Japanese broom-corn millet (*P. miliaceum*), and Japanese millet (*P. italicum*) yielded at the rate of about 40 bu. of seed per acre. The early white soy bean yielded 18.7 bu. of beans per acre, medium black 16 bu., and medium green 34.7 bu. The test of medium red, mammoth, alsike, and crimson clover was continued from last year (E. S. R., 9, p. 340). Mammoth clover gave the best results. The other kinds were injured to a considerable extent during the winter. The results of a comparison of sulphate and muriate of potash as fertilizers for clover were without special significance. Sweet clover (*Melilotus alba*), grown on the same plat, made a better growth this year than the year before, the yield being at the rate of about 12½ tons per acre. This is believed to be due to a larger supply of the appropriate nodular bacteria in the soil. The crop is recommended for green manuring rather than for fodder.

Experiments with alfalfa, saccaline, crimson clover, winter vetch, Idaho field or coffee pea (*Cicer arietinum*), Brazilian stooling flour corn, and black chaff or African millet are briefly noted. Alfalfa seed treated with Nitragin showed no advantage over untreated seed. Saccaline, crimson clover, Idaho field or coffee pea, and Brazilian stooling flour corn were found unprofitable as fodder crops. Black chaff or African millet resembles Kaffir corn, and both are regarded as inferior to maize for that climate.

Report of the director, H. BENTON (*Alabama Canebrake Sta. Rpt. 1897, pp. 5, 6, 8-11*).—The experiments described comprise culture, variety, and fertilizer tests of cotton; variety and culture tests of corn, and a comparison of standard varieties of potatoes.

Experiments with cotton.—Fertilizer tests were made on a sandy calcareous soil with application of sulphate of ammonia, sulphate of potash, acid phosphate, tankage, cotton-seed meal, and barnyard manure. The results show that acid phosphate applied singly or in combination did not increase the yield. Sulphate of ammonia and sulphate of potash applied alone or in combination gave good results. Sulphate of potash and tankage was found the most profitable combination on these soils. It is concluded from the results of the experiments that the sandy calcareous soils of that region are deficient in potash and ammonia. Shallow preparation of land with the cotton planted on beds gave better results than deep preparation with the cotton planted on the level. Among 7 varieties Truitt gave the best yield of seed cotton.

Experiments with corn.—Land plowed 4 in. deep with the corn planted in beds yielded 24.1 bu. per acre; land plowed 10 in. deep with corn planted on the level yielded 24.2 bu. There was practically no difference in the yields of Huffman Early and Welborn Conscience corn.

Potatoes.—The 4 varieties tested, Peerless, Beauty of Hebron, Early Rose, and Early Vermont, yielded 90, 93.5, 103, and 111 bu. of merchantable tubers per acre, respectively. The total yields ranged from 158.5 to 166.2 bu. per acre. An acre of Bunch Yam sweet potatoes yielded 207 bu.

Tobacco experiments.—A one-half acre plat yielded 335 lbs. of well-cured tobacco. General Grant and Bradley Broad Leaf and Cuban Seed Leaf and Havana Seed Leaf were about equal in yield. The yield of the latter two varieties was about two-thirds that of the former.

Millet, E. C. CHILCOTT and D. A. SAUNDERS (*South Dakota Sta. Bul. 60, pp. 127–140, fig. 6*).—In 1897 a number of varieties of millet were grown in a cooperative experiment with the Division of Agrostology of this Department. The seed was obtained from 13 seed firms in various parts of the United States and was sown on land of uniform quality in drills 2 ft. apart. The soil was cultivated and hoed during the season. Illustrations are given of samples taken at the best stage of growth for cutting for hay. All the varieties received under many different names are classified under the following groups, each of which is briefly described: Common millet (*Setaria italica*), Hungarian millet (*S. italica*), barnyard grass, cockspur grass (*Panicum crus-galli*), Golden Winter (*S. italica*), broom-corn millet (*P. miliaceum*), and German millet (*S. italica germanica*). Short notes are given on the growth of the varieties.

Forage crops of the James River Valley, J H. SHEPARD and E. C. CHILCOTT (*South Dakota Sta. Bul. 59, pp. 87–109, pls. 10*).—The experiments described are a continuation of work formerly reported (E. S. R., 9, p. 295) without any material change in the methods of work. About 100 varieties of forage plants, clovers, alfalfa, grasses, millets, peas, rape, spurry, vetches, sorghums, fodder, field and sweet corns, and sunflowers were tested on one-fourth acre plats, and 36 varieties of grasses and clovers were grown on small plats 1 square rod each for the purpose of comparing their habits of growth and their characters. No deleterious effects were produced by artesian well water used in irrigating the plats. The results on all plats are described in brief notes.

Potato experiments, C. VON SEELHORST (*Jour. Landw., 46 (1898), No. 1, pp. 43–49*).—Twenty tubers of the Magnum Bonum variety, similar in form, each having 9 eyes and weighing about 90 gm., were selected and planted in 2 lots. Ten of these tubers were planted and cultivated according to the Gülich method, and the eyes of the other 10 tubers were planted singly 20 cm. apart in rows 50 cm. apart. Of 88 eyes all but 2 grew.

The Gülich method consists in planting whole tubers a meter apart each way, and in bending the stems of the growing plants across each other and covering them well with earth. This extensive hilling is intended to favor the formation of stolons and thus to increase the yield of tubers.

The 10 tubers planted according to the Gülich method yielded 3,800 gm. of large and 500 gm. of small tubers. The 86 eyes of the other 10 tubers yielded 35,700 gm. of large and 2,900 gm. of small tubers. It is stated that in field experiments the results were not so striking, but still considerably in favor of planting the eyes singly. The Gülich method was not conducive to the formation of good-sized tubers. The author believes that hilling interferes with the assimilative functions of the plant.

In another experiment the use of different-sized tubers for seed and planting at different distances were tested on plats equal in size. The plants were grown 20, 40, and 60 cm. apart in rows 50 cm. apart. Large, medium, and small tubers, weighing 90 to 100, 50, and 30 gm. respectively were used for seed. The results are given below:

Yields per plat from different-sized tubers grown at different distances.

Distance between plants in the row.	Large seed tubers.			Medium-sized seed tubers.			Small seed tubers.		
	Large tubers.	Small tubers.	Starch content.	Large tubers.	Small tubers.	Starch content.	Large tubers.	Small tubers.	Starch content.
	Kg.	*Kg.*	*Per cent.*	*Kg.*	*Kg.*	*Per cent.*	*Kg.*	*Kg.*	*Per cent.*
20 centimeters	151.	8.2	16.6	104	6.5	15.4	81	5	14.7
40 centimeters	125.5	4.5	15.8	104	6.5	15.4	78	5	16.2
60 centimeters	117.5	5.5	15.8	96	6.5	15.1	82	4	14.5

Sugar beets in Idaho, C. W. McCurdy (*Idaho Sta. Bul. 12, pp. 37–73, figs. 8*).—This bulletin reviews the work with sugar beets in the State, discusses in a popular way the history of the industry, the world's production and consumption of sugar, and the climate, soil, and fertilizers suited to the sugar beet, and considers the factors which enter into the establishment of a beet-sugar factory. A number of varieties of sugar beets are described and compared. The relative worth of the different varieties deduced from analyses made by the station is given in the following table:

Comparison of varieties of sugar beets.

Name.	Maximum sugar content.	Minimum sugar content.	Average sugar content.	Purity.
	Per cent.	*Per cent.*	*Per cent.*	*Degrees.*
Kleinwanzleben	19.60	14.40	14.16	82.80
Metta	18.40	14.60	13.38	82.78
Vilmorin Imperial	18.20	10.60	14.10	85.42
Vilmorin Improved	16.60	14.40	11.77	75.55
French Red Top	15.90	10.70	13.65	82.70
Lane Imperial	15.70	10.60	13.44	81.69
New Danish	15.20	10.80	13.83	81.81

Analyses were made of large, medium, and small sized beets of 4 different varieties and the results show the highest sugar content and purity in the medium-sized beets, which weighed about 1 pound. Forty-one samples, including 20 from the station, were analyzed in 1897; the average sugar content was 15.17 per cent, with an average purity of

87.55 per cent. Twenty samples, grown by the station, averaged 15.28 per cent in sugar content and 92.55 in purity, while the rest of the samples gave an average sugar content of 17.07 per cent and the average coefficient of purity was 82.78. The results of analyses made in the chemical laboratory of this Department of samples grown in the State are also tabulated, together with the results obtained at other stations.

Sugar beets, R. H. McDowell and N. E. Wilson (*Nevada Sta. Bul. 37, pp. 16, fig. 3*).—This bulletin reviews the work with sugar beets in the State, reports on the work of the season of 1897, and gives directions for the culture of the crop. Vilmorin Improved and Kleinwanzlebener varieties are described and directions for making culture tests are given. The weather conditions for the season and the results of analyses of 22 samples of sugar beets, 10 of which were grown at the station, are tabulated. In shape the beets scored from 78 to 99.7 on a basis of 100, and the sugar content varied from 14.4 to 23.6 per cent. Farmers sent beets to the station varying from 14.4 to 19.4 per cent in sugar content, and reported a yield of 30 tons per acre.

Sugar beets in South Carolina, M. B. Hardin and J. F. C. DuPre (*South Carolina Sta. Bul. 34, pp. 1–7*).—This bulletin reports the results of cooperative culture experiments and variety and fertilizer tests with sugar beets.

In 18 samples of beets from different parts of the State the sugar in the juice varied from 7.4 per cent to 15.75 per cent, and the purity ranged from 62.2 to 87.1. No averages are given. Of 9 varieties, Red Top and Henderson White were most productive, each yielding over 12 tons per acre.

Fertilizer experiments were made on 12 plats, 3 of which served as check plats. All plats were fertilized with 160 lbs. cotton-seed meal, 120 lbs. acid phosphate, and 120 lbs. kainit per acre, applied broadcast and harrowed in. In addition to this general application, different amounts of these fertilizing materials and nitrate of soda were applied singly and in various combinations in the drill with the seed. The application in the drill of 100 lbs. nitrate of soda, 200 lbs. acid phosphate, and 400 lbs. kainit per acre gave the largest yield of beets. In general the complete fertilizers were more effective than the applications which furnished but one or two of the elements of plant food.

Experiments with winter wheat, C. A. Zavitz (*Ontario Agr. Col. and Expt. Farm Bul. 108, pp. 14*).—This work, which has been in progress for 9 years, comprises tests of varieties from the United States, England, Scotland, Germany, France, Russia, and Canada, and experiments in different dates of seeding, methods of soil preparation, methods of seeding, selection of grain for seed, quantities of seed per acre, application of fertilizers, treatment of smut-infested seed, the yield and quality of wheat cut at different stages of maturity, and the value of seed from wheat cut at different stages of maturity. This bulletin summarizes the experiments of 1898 and gives the average results of

some of the experiments conducted for several years in succession. A previous bulletin on this work has been noted (E. S. R., 7, p. 394).

Ninety-two varieties were sown on plats at the rate of 2 bu. per acre during the first week of September. All varieties ripened between July 14 and 21 and gave an average of 3.4 tons of straw and 42.9 bu. of grain per acre, and an average weight of grain of 63 lbs. per measured bushel. Of 48 varieties grown for 5 years in succession Dawson Golden Chaff, Early Genesee Giant, Egyptian, Imperial Amber, Early Red Clawson, Reliable Golden Drop, Russian Amber, and Egyptian Amber, in the order named, gave the best results, the average yields varying from 45.3 to 52.6 bu. per acre. Among 44 new varieties of winter wheat grown in 1898 Gold Coin, Silver Dollar, White Golden Cross, Pedigree Genesee Giant, Oregon, Forty Fold, and Zerena were the most productive, yielding from 50 to 52 bu. per acre. The average yield of Dawson Golden Chaff and Early Genesee Giant, grown for 3 years in succession on 25-acre fields, was about 36 bu. per acre. The average results for 5 years show that Egyptian Amber, Emporium, Bissell, Long Berry Red, Turkish Red, and Geneva were least affected with rust. During a period of 9 years there has been a variation from 26.1 to 52.9 bu. in the average yield of grain per acre, from 1.2 to 4 tons in the average yield of straw per acre, and from 55 to 63.3 lbs. in the average weight of grain per measured bushel.

The results from the test in seed selection show that large plump seed produced 6.3 bu. per acre more than small plump seed and 8.25 bu. more than shrunken seed. Seed grain which had been broken in threshing yielded only one-fifth as much as large plump seed.

The results of sowing winter wheat on different dates indicate that best results are obtained by sowing during the last week in August or the first week in September.

In tests conducted for 5 years in succession 1½ bu. of seed per acre gave better results than 1 bu. per acre and similar results to using 2 bu. of seed per acre. It was also found that sowing broadcast and drilling with the grain drill gave results practically alike. The following table gives the results of experiments in the preparation of soil for winter wheat:

Results of preparing land in different ways for winter wheat.

Soil preparation, 1896 and 1897.	Average results for two years (4 tests).				
	Height of crop.	Crop lodged.	Weight of grain per measured bushel.	Yield per acre.	
				Straw.	Grain.
	Inches.	*Per cent.*	*Pounds.*	*Tons.*	*Bushels.*
20 tons farmyard manure per acre on bare summer fallow	52.4	45.0	60.8	3.4	40.4
Peas plowed under	51.7	31.3	60.8	2.7	37.0
Bare summer fallow	52.3	40.0	60.7	2.6	35.0
Rape plowed under	50.7	30.8	60.4	2.4	33.7
Crimson clover plowed under	50.7	22.5	60.5	2.3	31.2
Buckwheat plowed under	50.5	17.5	60.4	2.0	29.9

A study of the effect of cutting grain at different stages of maturity for several years in succession showed that the largest yield of grain and the best quality of seed were produced from the crop which was allowed to mature before cutting.

Experiments in treating seed wheat for the prevention of smut were conducted for 3 years. Grain from untreated seed contained an average of 170 smut balls per pound, while seed treated with potassium sulphid produced an average of 12 smut balls and that treated with either copper sulphate or hot water less than 1 ball of smut per pound of grain.

Some of the results of cooperative experiments with winter wheat published elsewhere (E. S. R., 10, p. 36) are given in the bulletin.

Wheat, winter oats, barley, and lime experiments, R. H. MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 56, pp. 153–166*).—The experiments consisted of variety tests of wheat and winter oats; a study of the effects of lime on the production of wheat, hay, and corn; a test of lime and cowpeas as a preparation for wheat; trials of seeding winter oats at different times; and a test of the hot-water treatment of barley seed for the prevention of smut.

The results of variety tests of wheat made in 1896 and 1897 are tabulated. Among the varieties tested for 6 years Fultz gave the highest yield, 37.8 bu. per acre, followed by Currell Prolific, Wisconsin Triumph, and Valley, yielding 36.2, 34.9, and 33.7 bu. per acre, respectively. Beal, Ruby, Terry, and Rocky Mountain are considered promising new varieties.

Different amounts of lime up to 40 bu. per acre, applied to a number of wheat plats, showed that the increase in yield was in direct proportion to the amount of lime applied, but larger applications did not give satisfactory results. To test the effect of lime and cowpeas as a preparation for wheat, 2 plats of very poor soil were prepared for seeding in the spring. One plat received an application of 40 bu. of stone lime and then cowpeas were drilled in on both plats at the rate of 5 pk. per acre. The growth of the cowpeas was best on the limed plat. The cowpeas were plowed under and the plats were sown to wheat and timothy in the fall and clover was sown on both plats the next spring. There was an increase of only 1.6 bu. per acre in the yield of wheat on the limed plat, but this plat has "a very fine stand of both clover and timothy, while there is scarcely any clover and a poor stand of timothy on the plat receiving no lime." The test of the effect of lime on hay and corn showed a decided gain for both crops in favor of the limed plat.

The varieties of winter oats tested were Hatchett, Black Winter, Winter, and Virginia Gray, the latter producing the best yield. For 2 years in succession better results were obtained from sowing winter oats September 1 than from sowing September 15 and 30.

Hot-water treatment of seed barley proved effective in the prevention of smut. The plat on which the seed had been treated had practically

no smut, while on the plat which had been seeded with untreated seed from 15 to 20 per cent of the heads were smutted.

Field experiments with wheat, oats, and barley, L. A. MERRILL (*Utah Sta. Bul. 56, pp. 171–193*).—Variety tests of wheat have been carried on for a number of years and the report of this work is here given in detail. Of 16 varieties of spring wheat and 14 varieties of winter wheat, the following have given an average yield of over 20 bu. per acre:

Results of variety tests of wheat.

Kind.	Years.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	Average.
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Spring wheat:									
Common	2	....	....	....	....	16.89	34.42	....	25.65
Gillings's mixture	2	....	....	....	22.00	....	29.12	....	25.56
Niagara	6	19.00	16.66	13.21	26.44	16.89	33.76	....	20.99
Whitington	5	15.55	14.44	17.11	24.22	....	32.43	....	20.75
Granite	6	28.88	12.22	10.54	22.22	20.22	29.79	....	20.64
Nox 53	5	19.99	13.33	19.00	17.33	....	33.10	....	20.55
Fall wheat:									
Sonora	2	....	....	....	....	....	33.39	15.33	24.36
Early Red Clawson	2	....	....	....	....	....	17.65	22.99	20.32
Red Cross	2	....	....	....	....	....	23.61	16.55	20.08

In 1897 34 varieties of fall wheat were tested on small plats. The seed was obtained from the Ontario Agricultural and Experimental Union and the Kansas Experiment Station. Early Ripe, Velvet Chaff, Siberian, and Turkey, in the order given, produced the best yields. "In irrigated districts fall wheat will not do as well as spring wheat under the same treatment."

A test of sowing different quantities of wheat per acre has been previously reported (E. S. R., 6, p. 543). It was shown by an experiment that irrigating fall wheat in the fall, when there is sufficient rain to bring up all the grain, is detrimental to the yield of grain and straw. The best results were obtained by one irrigation made in the spring. In this experiment fall wheat produced slightly better results than spring wheat under the same treatment.

Results of experiments indicated that sowing wheat in November is better than sowing wheat earlier and that drilling is better than broadcasting for fall sowing. A plat rolled after seeding gave slightly better results than a plat rolled before seeding or a plat left unrolled.

The results of variety tests of oats for a number of years are given in tables and a number of the leading varieties described. The varieties recommended are American Banner, Canada White, Badger Queen, Wide Awake, Clydesdale, Nameless Beauty, American Beauty, and Prince Edward Island. The last-named variety is a prolific black oats. The results of experiments indicate that oats should be sown at the rate of 2 bu. per acre. For 4 years oats sown April 22 gave better results than oats sown May 10 or June 1.

Of 4 varieties of barley grown at the station for 6 years or more, Lump Blue gave the best results, the average yield being 32.43 bu. per acre. A number of varieties are described and the results of all varieties are given in tables.

The influence of a temporary low temperature on the development of winter grains when sown in spring, C. VON SEELHORST (*Jour. Landw., 46 (1898), No. 1, pp. 50, 51*).—Four pots each of winter rye, winter wheat, and winter rape, 2 weeks after the seed had been sown, were kept at a temperature of from 0 to 2° C. for 2 weeks; and 6 of these pots were then placed in the open air and restored to natural conditions of growth. The other 6 pots were kept at this temperature for 1 week longer and then placed in a temperature of 5 to 7° C. below freezing for another week. Each pot produced ripe grain. The series of pots which had been subjected to a low temperature for the shorter period of time ripened about 2 weeks before the other series. The rape ripened during the latter part of July, the rye during the latter part of August, and the wheat during the first half of September. The author concludes that a temporary low temperature during the early vegetative period as tested in these experiments hastens the development of the plant. It is found in practice that winter grains when sown in spring either do not head during the following summer, or that the heading is very incomplete.

On the influence of smaller and larger amounts of water on the development of some cultivated plants, A. MAYER (*Jour. Landw., 46 (1898), No. 2, pp. 167-181*).—Pot experiments during a number of years with rye, wheat, barley, and oats are reported, in which the moisture content of the soils was maintained uniformly at fixed percentages of their total water capacity from very wet to very dry (10 to 96 per cent). As a rule the less the moisture the greater the relative yield of grain, and as a consequence the less the percentage of fiber the greater the percentage of protein and pure albuminoids and the shorter the period of growth. The presence of large amounts of water in the soil apparently tended to check seed production and caused the formation of fiber instead of carbohydrates. As regards water requirements, the plants experimented with stood in the following order: Oats, wheat, rye, and barley. In one series of experiments the optimum percentages of water for the different crops seemed to be as follows: For oats 90 per cent of the water capacity of the soil, wheat 80 per cent, rye 75 per cent, and barley 62 per cent. The results of other experiments, however, show that these figures can not be accepted as definitely fixing the relative water requirements of these crops.

Notes on flax and hemp, H. T. FRENCH (*Oregon Sta. Bul. 54, pp. 1-11, pl. 1, figs. 2*).—The results of culture experiments on flax and hemp are briefly discussed and notes on the method of growing these crops are given. Four varieties of flax—Belgian, Pure Riga, Finest Dutch Sowing, and White Balsam Dutch—were grown in comparison and their relative merits, so far as determined from one year's experiments, are pointed out.

Variety tests of potatoes, A. SEMPOLOWSKI (*Deut. Landw. Presse, 25 (1898), No. 99, p. 1024*).—Thirty-three varieties were tested and the results are here reported in tables and discussed. The variety Wohltmann gave the best results.

Second report on potato culture, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Rpt. 1898, pp. 385-406, figs. 4*).—A reprint of Bulletin 140 of the station (E. S. R., 9, pp. 1044, 1060, 1072).

Cultivation of ramie in foreign countries (*Spec. [U. S.] Consular Rpts., 15 (1898), pp. 111-130*).—Reports are given by the United States consuls on the cultivation of ramie at Amoy, Chefoo, Chungking, Fuchau, and Hankau, China; Calcutta, India; Yokohama, Japan; Seoul, Korea; Jamaica, and Guatemala.

Sugar beets, W. A. WITHERS (*North Carolina Sta. Spec. Bul. 49, folio*).—Directions for growing sugar beets, given with a view to conducting cooperative culture experiments.

Sugar-beet investigations, J. L. STONE, L. A. CLINTON, G. C. CALDWELL, ET AL. (*New York Cornell Sta. Rpt. 1898, pp. 493-574, figs. 9*).—A reprint of Bulletin 143 of the station (E. S. R., 10, p. 143).

Notes on field experiments with tobacco in Massachusetts, 1893-1896, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1897, pp. 128-136*).—The experiments are briefly described and the results tabulated. These experiments were reported in a former bulletin of the station (E. S. R., 9, p. 345).

Winter oats, SCHACHT (*Deut. Landw. Presse, 25 (1898), No. 73, p. 789*).—Practical notes on growing winter oats with reference to seed and fertilizers.

Variations in the water content of shelled corn (*Deut. Landw. Presse, 25 (1898), No. 98, p. 1017*).—The quality of the grain, the weather, and the methods of storing are given as the factors which influence the water content. The variations in the water content for each month are given. It is stated that considering the normal water content of Hungarian varieties of corn to be 12 per cent, their starch content varies from 57 to 65 per cent.

Experiments with alinit, O. LEHMANN (*Deut. Landw. Presse, 25 (1898), No. 85, pp. 905, 906*).—Oats and barley were inoculated with alinit before sowing and the effect of alinit as a fertilizer compared with that of nitrate of soda. The oats plats received a general application of kainit and Thomas slag, and the barley plats received combinations of Thomas slag, quicklime, and kainit, in addition to alinit or nitrate of soda. The results show that alinit failed to increase the yield of either crop perceptibly, while nitrate of soda in both cases gave an increase in yield in proportion to the amount applied.

Two tests of alinit, J. LUTOSLAWSKI (*Deut. Landw. Presse, 25 (1898), No. 87, p. 920*).—Seed wheat was inoculated with alinit and the resulting crop compared with wheat grown from uninoculated seed. The tests were made by two different parties. In one case the inoculated seed gave a smaller and in the other a larger yield than the uninoculated seed.

Concerning alinit, SALFELD (*Deut. Landw. Presse, 25 (1898), No. 91, p. 963*).—A note stating that quicklime applied as a fertilizer is not detrimental to the action of alinit or inoculating soils.

Alinit, V. ALPE (*Prog. Agr. et Vit., 30 (1898), No. 51, pp. 739-741*).—The author quotes the investigations of a number of experimenters with this substance and concludes it is probably without practical value. Comparing it with nitrate of soda as a fertilizer the yield of rye was 3 times as great where soda was used as where alinit was employed. Dr. Gerlach is quoted as having found it, instead of a pure culture as is claimed, a mixture of at least 5 distinct species of bacteria.

HORTICULTURE.

Fertilizers for garden crops, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1897, pp. 23-26*).—This is a report of an experiment with peas, beets, squashes, and celery to compare sulphate of ammonia, nitrate of soda, and dried blood as sources of nitrogen, and sulphate of potash with muriate of potash as sources of potash. Phosphoric acid was furnished in all cases in the form of dissolved boneblack. The fertilizers in each case supplied phosphoric acid at the rate of 50.4 lbs., nitro-

gen 60 lbs., and potash 120 lbs. per acre. Tables are given showing the yields of the different crops of the various plats. In the case of beets and peas sulphate of potash appeared distinctly superior to muriate of potash. With peas, dried blood gave a somewhat larger crop than nitrogen in other forms and with beets nitrate of soda was greatly superior to the other forms. When sulphate of ammonia and muriate of potash were used together, the growth of both peas and beets was decidedly inferior to that where other combinations were used. The injurious effect is ascribed to the formation of ammonium chlorid. The celery and squashes were failures on account of unfavorable weather.

The reciprocal effect of stock and scion, L. DANIEL (*Jour. Soc. Nat. Hort. France, Congrès Horticole, 1898, pp. 95–112*).—The subject is treated under two heads—the direct reciprocal influence of the scion and stock, and the indirect influence of the stock upon the offspring of the scion. Many of the results given have previously been reported (E. S. R., 5, p. 1089; 9, p. 945). Precautions were taken to prevent hybridization. The following conclusions are given:

The reciprocal effect of stock and scion can not be denied, though it does not always act with the same intensity. This effect is divided into effects of general nutrition, shown in size, vigor resistance to parasites, etc., and effects of a specific nature seen in both external and internal morphological characteristics of vegetative organs, as in Helianthus, and of reproductive organs, as in beans and Solanaceæ. The effects of a specific nature are more pronounced in cases of mixed grafting, while the general effects are decreased by mixed grafting and increased by ordinary grafting. The variations due to grafting are often hereditary, appearing in the first seed generation.

There are numerous practical applications of the reciprocal effect of scion and stock, such as increase in the size of fruits, improvement of the flavor of fruits and certain vegetables, production of new varieties in which the color of the flower, the form of the fruit, or the vegetative organs are modified. The effects of grafting are more marked in herbaceous than in woody plants, and also more marked in the offspring of the grafted plant than in the plant itself. Grafting, as a means of retaining variations acquired under culture, is useful only in the case of trees, and the difference between seedling fruit trees and the varieties producing them may be explained in part by the effect of grafting on the progeny of grafted plants.

Grafting which produces a variation in the seed may be used to produce new varieties. Since this variation can frequently be directed in a given way, it is possible almost to a certainty by repeated graftings to impart definite characteristics of flavor, form, color, etc., to plants which vary readily under culture. In the case of other plants grafting may produce variations which, though difficult to obtain, after once appearing, may be directed in a definite way.

Methods of tree planting, F. W. CARD (*Nebraska Sta. Bul. 56, pp. 11–24, figs. 4*).—In this bulletin the author describes various experiments

in tree planting and makes suggestions for planting apple trees under the conditions prevalent in eastern Nebraska. At the end of the second year of an experiment to determine how old trees should be when planted, the average size of the different sets decreased in the following order: Three-year-old trees, two-year whips and two-year tops on three-year roots, two-year limbed trees, and one-year trees; but not in all cases in proportion to the differences in their ages when planted. While in the opinion of the author it is much too soon to pass final judgment upon these results, he remarks that "two-year limbed trees are eminently satisfactory and desirable for ordinary planting, but with good care even one year-old trees may give good results and gain on older trees planted at the same time." On the method of digging large holes through the compact subsoil and filling these with mellow surface soil in which to plant the trees, no conclusions could as yet be drawn from the experiments. Several methods of root pruning were tried, which varied from cutting the roots back to only 1 or 2 in. in length to leaving them wholly untrimmed, just as received from the nursery. The author says: "These experiments indicate that all healthy roots which are found on a tree as shipped from the nursery should be left there in planting. The results upon this point are more emphatic than upon any other question embraced in the experiments." There appeared to be no advantage in making a fresh, clean cut at the ends of sound roots. The conclusions drawn from the experiments on top pruning are unfavorable to cutting back apple trees severely at planting time. Those left entirely unpruned or with the branches shortened about one-half did better than those pruned to a cane or grown as a whip in the nursery.

Cooperative experiments on fall planting were conducted at the Nebraska Station and by H. C. Irish at the Missouri Botanical Garden, at St. Louis, Missouri, the object being to determine if root growth can take place while the tops are dormant. The experiments at both places showed that fall-planted trees do make some root growth in the autumn succeeding planting, and in the spring before the leaves start. While the experiments were not designed to determine the desirability of fall planting, the author says they indicate that in the locality of St. Louis fall planting gives good results, but upon the plains it is generally found to be unsatisfactory, owing largely to the dry open winters.

Ornamental planting, F. W. CARD (*Nebraska Sta. Bul. 55, pp. 10, figs. 7*).—This bulletin treats of the lawn, and the arrangement, grouping, and choice of plants in ornamenting the home. A list of some ornamental plants suitable for Nebraska planting, with descriptive notes, is given. Among those found satisfactory at the station are the following: *Shrubs.*—Spiræa, sand cherry, *Rosa rugosa*, button bush, red branched dogwood, tamarix, viburnums, syringas, honeysuckles, sumachs, snowberry, juneberry, and gooseberry. *Climbers.*—Virginia creeper, wistaria, wild clematis, hop, and wild grape. *Herbaceous perennials.—Gaillardia grandiflora*, golden marguerite, perennial sweet pea.

Notes on cold storage, F. W. RANE (*Amer. Gard., 19 (1898), No. 194, pp. 634, 635*).—This is taken from a paper read before the Society for the Promotion of Agricultural Science. The author gives an account of a method of cold storage which has been tried at the New Hampshire Station and describes the construction of a storage room built in the cellar of the station barn.

"There are few days at a stretch from September until late in spring in New England, for instance, but that the temperature falls at some time sufficiently to utilize it for cold storage. Being prepared to retain this temperature in cellars or buildings constructed for the purpose until a similar or lower temperature is again realized is the key to its success. From experience it is believed this simple method can with comparatively little care and expense be made more useful at present (in this our transitory stage) than all others. The ordinary house cellar or portion of a barn cellar will answer for the storage room if the simple principles of construction for the retention of dry cold air as well as a proper system of ventilation are considered."

The following temperatures are said to be the most satisfactory for the preservation of some common fruits and vegetables: Apples, 30 to 45°; berries, 36 to 40°; celery, 35°; cranberries, 34 to 38°; peaches, 45 to 55°; pears, 36°; onions, 34 to 40°; potatoes, 36 to 40°; asparagus, 34°; cabbage, 34°, and grapes, 36 to 38°.

Report of the horticulturist, S. T. MAYNARD (*Massachusetts Hatch Sta. Rpt. 1897, pp. 71–73*).—An outline of the work of the year.

Garden crops in the James River Valley, J. H. SHEPARD and E. C. CHILCOTT (*South Dakota Sta. Bul. 59, pp. 109–124, figs. 6*).—Notes on variety tests of onions, spinach, salsify, leeks, chicory, kohl-rabi, parsnips, radishes, lettuce, carrots, beets, mangels, turnips, ruta-bagas, and beans, with a list of the following varieties recommended as well adapted to the State: *Tomatoes.*—Salzer First of All, and Early Ruby. *Cabbage.*—Salzer Earliest, Jersey Wakefield, Henderson Succession, Ideal, and Flat Dutch. *Celery.*—Self-Blanching, Giant Pascal. *Squashes.*—Summer Crookneck, Stickler Summer Crookneck, Hubbard, Sibley, and Giant Chili. *Cucumbers.*—Fardhook and Boston Pickling. *Watermelons.*—Early varieties. *Muskmelons.*—Rough-skinned, strongly netted varieties.

Vegetable culture, J. M. FITCH (*Lawrence, Kans.: F. Barteldes & Co., pp. 30*).—Brief, practical suggestions for the culture and selection of the most profitable vegetables for market or home use.

Nitrate of soda in garden culture: Its adulterations, H. DAUTHENAY (*Rev. Hort., 70 (1898), No. 23, pp. 561, 562*).—Notes the advantageous use of nitrate of soda on "all vegetables that should remain in the soil a minimum of time and at the same time give a maximum return." Directions are given for detecting adulteration, which often occurs.

Studies and illustrations of mushrooms, G. F. ATKINSON (*New York Cornell Sta. Rpt. 1898, pp. 337–366, figs 26*).—A reprint of Bulletin 138 of the station (E. S. R., 9, p. 646).

The apple in North Carolina, W. F. MASSEY (*North Carolina Sta. Bul. 149, pp. 307–325*).—A popular bulletin giving suggestions as to the culture of apples in North Carolina.

History of the York Imperial apple (*Montana Fruit Grower, 8 (1898), No. 28, p. 1*).

History of the Yellow Newton apple (*Montana Fruit Grower, 8 (1898), No. 30, p. 4*).

The Fameuse apple as the head of a family, J. CRAIG (*Amer. Gard., 20 (1899), No. 212, p. 27, fig. 1*).—Notes on the introduction of this variety into America, some of its seedlings, and a description of the Scarlet Pippin.

The plum and its culture, J. W. KERR (*Amer. Gard., 19 (1898), No. 210, pp. 889, 890*).—This is a paper read before the Maryland Horticultural Society. The author makes a plea for "American plums for America," and discusses the relative merits of American and Japanese plums in this country.

The early botanical views of Prunus domestica, F. A. WAUGH (*Bot. Gaz., 26 (1898), No. 6, pp. 417-427*).—The author gives the synonymy of the early varieties of this species, with notes and discussions.

The botany of plums and cherries, C. E. BESSEY (*Rpt. Nebraska Hort. Soc., 26 (1895), pp. 163-178, figs. 12*).—Systematic descriptions are given of the various species of the genus Prunus, from which have been developed the cherries, plums, almonds, and apricots of cultivation.

Third report upon Japanese plums, L. H. BAILEY (*New York Cornell Sta. Rpt. 1898, pp. 369-382, figs. 9*).—A reprint of Bulletin 139 of the station (E. S. R., 9, p. 1053).

On the dropping of the buds of peach trees, C. MAYER (*Agr. Jour. Cape of Good Hope, 13 (1898), No. 11, pp. 698-701*).—Observations, discussion, and a list of varieties badly affected, less affected, and hardly affected.

The botany of the bush fruits, F. W. CARD (*Rpt. Nebraska Hort. Soc., 27 (1896), pp. 241-256*).—The botany of the more important bush fruits is given, in which are described the species of raspberry, blackberry, currant, gooseberry, Juneberry, Buffalo berry, tree cranberry, and goumi (Elæagnus). The author describes 18 species of Rubus and 8 of Ribes in cultivation.

Notes on the botany of the strawberry, C. E. BESSEY (*Rpt. Nebraska Hort. Soc., 27 (1896), pp. 227-240*).—Descriptive notes are given of the 11 species of Fragaria which are cultivated to a greater or less degree. It is stated that 7 are native to North America, the others being native to Europe, Asia, and South America.

Mixed grapes: Singular results from crossing different varieties, C. P. CLOSE (*Amer. Gard., 19 (1898), No. 208, p. 857*).—Notes on crosses made with varieties of grapes of all colors. In every instance but one the resulting cluster was the same color as the female parent.

The botany of the grape, C. E. BESSEY (*Rpt. Nebraska Hort. Soc., 26 (1895), pp. 7-26, figs. 12, maps 2*).—The author gives botanical descriptions of 11 species of grapes which are cultivated to a greater or less extent, together with notes on their geographical distribution, their nativity, and the more important varieties which have been developed from each.

The effect of the graft on the flavor of the fruit (*Gard. Chron., 3. ser., 24 (1898), No. 614, p. 246; Agr. Jour. Cape of Good Hope, 13 (1898), No. 11, pp. 703-705*).—Abstracts and discusses the results of experiments made by M. Daniel relating to the reciprocal influence of the scion on the stock, and *vice versa* (see p. 637).

The modern practical cut-flower grower, O. SCHMERBUSCH (*Der practische Schnittblumenzuchter. Bonn, pp. 224*).—An eminently practical work, based on the author's own experience. An important feature is the tabulation of both cost of production and profits under each method of culture.

The principles and practice of bulb growing, W. C. WORSDELL (*Gard. Chron., 3. ser., 24 (1898), No. 625, pp. 442, 443, figs. 5*).—One of a series of articles on this subject.

The white cattleyas, H. T. CLINKABERRY (*Amer. Gard., 19 (1898), No. 209, pp. 880, 881*).—A list of the white varieties, with descriptive notes.

Caladiums, anthuriums, alocasias, and other hot-house aroideæ, J. RUDOLPH (*Caladium, anthurium, alocasia, et autres aroïdées de serre. Paris, pp. 223, figs. 28*).—A strictly horticultural and practical work.

The cultivated species of Bulbophyllum (*Wiener Illus. Gart. Ztg., 22 (1898), No. 11, pp. 388-392*).—A list of the species, with descriptive and cultural notes.

Fourth report upon chrysanthemums, W. MILLER (*New York Cornell Sta. Rpt. 1898, pp. 657-689, figs. 12*).—A reprint of Bulletin 147 of the station (E. S. R., 10, p. 438).

The year's work in chrysanthemums, E. D. SMITH (*Amer. Gard., 19 (1898), No. 210, p. 897*).—A tabulated report of the work of the committees of the Chrysanthemum Society of America.

Chrysanthemums—certificated varieties of 1898, J. E. WHYTE (*Florists' Exchange, 10 (1898), No. 50, pp. 1177–1179, figs. 25*).—Photographs and originators' descriptions of 25 out of 32 varieties certificated by the Chrysanthemum Society of America during 1898.

Specimen bush-grown chrysanthemums—how a successful exhibitor does the work, W. C. RUSSELL (*Amer. Gard., 19 (1898), No. 207, pp. 837, 838, pls. 3*).

The bladder ferns (Cystopteris) (*Garden, 54 (1898), No. 1413, p. 485, fig. 1*).—Botanical and cultural notes. Especially describes a new method of growing *Chrysopteris montana*. For many years the culture of this species has been considered very difficult. The culture suggested, which is stated to be "as simple as effective," consists in excavating a pit and filling it to the depth of 12 in. with coarse and small brick rubble and covering with only a very little loam and leaf mold, in which the rhizomes are planted.

Bulbous irises (*Garden, 54 (1898), No. 1412, pp. 470, 471, pl. 1, figs. 4*).—Cultural notes and a list of the varieties best adapted for cultivation.

Raising palms from seed, C. W. RANKIN, M. HORVATH, M. MUNTE, and J. E. HINKLE (*Amer. Gard., 20 (1899), No. 211, pp. 3–5*).—Essays submitted in competition for a prize.

Placeas (*Garden, 54 (1898), No. 1414, pp. 510, 511, pl. 1*).—Botanical and horticultural notes.

About pruning roses, J. MEEHAN (*New England Florist, 4 (1898), No. 42, p. 509*).

The hardy sumachs, W. J. BEAN (*Garden, 54 (1898), No. 1414, pp. 505–507, pls. 4*).—Descriptive and cultural notes and list of hardy species.

The beginning of the culture of plants under glass, G. GIBAULT (*Jour. Soc. Nat. Hort. France, 3. ser., 20 (1898), pp. 1109–1117*).—Notes upon the industry in ancient Rome and its renaissance in France.

Notes on watering, F. CRANEFIELD (*Amer. Florist, 14 (1899), No. 554, pp. 698, 699*).—Report upon experiments pointing to the conclusion that the growth of ordinary greenhouse and garden crops is not affected by the temperature of any water usually available for irrigation purposes.

Greenhouse heating, H. W. GIBBONS (*Amer. Gard., 19 (1898), No. 204, pp. 789–791*).—The author discusses the relative merits of steam and hot-water heating for particular purposes and considers the arrangement of pipes, boilers, etc.

FORESTRY.

Internal temperatures of tree trunks, R. A. EMERSON (*Proc. Nebraska Acad. Sci., 6, 1896, pp. 245–252, figs. 4*).—Observations on the internal temperatures of tree trunks and limbs were made continuously during the summer of 1894, and at intervals during the spring and summer of 1896, and the winter of 1896–97. Temperatures were taken in several apple trees, a cottonwood, a box-elder, and a maple. During the first summer temperatures were taken regularly from one to three times daily. After that readings were made hourly and in some cases at intervals of 5 to 10 minutes throughout a considerable part of the day. Temperatures were taken at the center and at the surface of trunks and limbs when exposed to direct sunlight and when shaded by foliage and by screens, and these were compared with temperatures taken in the air, both in shade and in sunlight. The temperatures of live limbs were compared with those of sound dead limbs as found and after being soaked in water. A brief account is given of the methods used in taking the temperatures. Charts are given showing

the changes in temperature of the air and of limbs under various conditions.

When the trunks and limbs of trees are shaded their temperatures, if above the freezing point of water, vary according to the temperature of the outside air, but show somewhat smaller diurnal variations and change more slowly, so that in shade tree temperatures above 0° C. are higher than the air temperature when both temperatures are falling and lower when both are rising. On the other hand, when exposed to strong sunlight, again provided their temperatures are above the freezing point of water, limbs and trunks of trees exhibit much greater diurnal variations of temperature, much greater maximum daily temperatures, and quicker changes in temperature than shaded limbs, and even than the outside air, so that in strong sunlight tree temperatures above 0° C. are higher than the air temperature, not only when both temperatures are falling, but are often higher also when both are rising. One side of even a small limb may therefore have a temperature much higher than the air and the opposite side at the same time a temperature lower than the air. The temperatures of the center of limbs change more slowly than those of the surfaces and the extreme daily variations of temperature are less. Above the freezing point of water, the temperatures of water-soaked dead limbs behave like those of live limbs, while the temperatures of normal dead limbs change more quickly than those of live limbs and the extreme daily variations of temperature are greater. The temperatures of normal dead limbs, like the temperature of the air, in both rising and falling, pass the freezing point of water without appreciable retardation. The temperatures of water-soaked dead limbs, in both rising and falling, are noticeably retarded at or near the freezing point of water, but having once passed this point proceed rapidly again. The temperatures of live limbs, in rising, behave like those of water-soaked dead limbs; in falling, however, they are not only retarded at the freezing point of water, but even after having passed this point their descent continues slow.

An observation on annual rings, F. W. CARD (*Proc. Nebraska Acad. Sci., 6, 1896, pp. 243, 244*).—The author conducted an experiment to ascertain the relation between growth rings and annual rings in trees. A piece of bark was removed early in the season from the north side of an ash tree and also from a maple. Later in the season both trees were stripped of the leaves, which were renewed within 3 weeks. In November both trees were cut down and a cross section made where the bark had been removed, and the ring of growth for that year was apparently as uniform as for others. It seems probable that a greater interference with normal conditions of growth than that in the experiment is necessary to produce more than one growth ring in a season.

Osier culture, J. M. SIMPSON (*U. S. Dept. Agr., Division of Forestry Bul. 19, pp. 27*).—The author gives a historical sketch of the cultivation and use of osiers, together with notes on their geographic distribution and characteristics. The subject of varieties is treated at

some length. Among the European willows which are said to be most suitable for basket making are the following: *Salix amygdalina*, *S. lucida*, *S. fragilis*, *S. caprea*, *S. prunifolia*, *S. viminalis*, and *S. purpurea*. Notes are given on the selection and preparation of soil, with directions for preparing cuttings, planting, cultivation, fertilizing, and harvesting the product. The more common and troublesome fungus diseases and insect enemies are noted, together with suggestions for the prevention of their attacks. Notes are given on the manufacture of willow ware, cost of basket making, production and price of osiers in this country, and quotations are given from letters stating experiences of various American growers. For the benefit of persons interested in osier culture a list of the principal willow growers of this country is appended.

Experimental tree planting in the plains, C. A. KEFFER (*U. S. Dept. Agr., Division of Forestry Bul. 18, pp. 94, pls. 5, fig. 1*).—The effect of heat, light, moisture, soil and soil moisture, and atmospheric moisture as affecting tree growth is stated and notes given on the introduction of exotic trees, hardiness, rules for mixing species, pure planting, mixed planting, nurse trees, and the use of evergreens in Western planting. The objects of experimental plantations are stated, and a list of 39 species of trees employed in these plantings of trees, as follows: Conifers: *Pinus strobus*, *P. resinosa*, *P. ponderosa scopulorum*, *P. divaricata*, *P. sylvestris*, *P. austriaca*, *Larix laricina*, *L. europæa*, *Picea canadensis*, *P. excelsa*, *Pseudotsuga taxifolia*, *Abies concolor*, and *Juniperus virginiana*. Broad-leaved species: *Juglans nigra*, *Populus tremuloides*, *P. deltoides*, *P. certinensis*, *Betula alba*, *B. lutea*, *B. lenta*, *Ostrya virginiana*, *Castanea dentata*, *Quercus alba*, *Q. macrocarpa*, *Q. prinus*, *Q. platanoides*, *Q. rubra*, *Ulmus americana*, *Morus alba tatarica*, *Liriodendron tulipifera*, *Prunus serotina*, *Gleditsia triacanthos*, *Robina pseudacacia*, *Acer saccharinum*, *A. negundo*, *Fraxinus americana*, *F. lanceolata*, *Catalpa speciosa*, and *Artemisia abrotanum tobolskianum*.

The experimental plantations of Kansas, Nebraska, Colorado, South Dakota, Utah, and Minnesota are described and the results as far as shown by the experiments are stated. Notes are given on growing evergreens from seed and directions for the preparation of an evergreen seed bed are included.

List of publications relating to forestry in the Department Library (*U. S. Dept. Agr., Library Bul. 24, pp. 93*).—This bulletin contains a list of the works relating to forestry in the library of this Department, together with the forest library of the late Prof. Franz von Baur, which was purchased by this Department in 1897. A catalogue is arranged by authors with a separate list of serial publications and a subject index. No works have been included which do not have a direct bearing on the subject, and those relating to landscape gardening and botany are purposely omitted.

Check list of the forest trees of the United States, G. B. SUDWORTH (*U. S. Dept. Agr., Division of Forestry Bul. 17, pp. 144*).—This publication is a revised and condensed edition of Bulletin 14 of the division (E. S. R., 9, p. 452), and contains the scientific and common names of the trees of North America, the synonomy and explanation of the former bulletin being omitted. In order to secure better identi-

fication and to increase the value of the list a geographical range of species has been added in a concise form. The present list comprises an enumeration of the trees indigenous to the United States, 495 in number, and a few thoroughly naturalized and natural and artificial varieties and hybrids have been also cited.

The red beech in coppice and forest tree growth, H. FISCHBACH (*Allg. Forst u. Jagdw. Ztg., 74 (1898), No. 12, pp. 377–379*).

On the histology of the pine, E. STRUMPFE (*Anzeig. Akad. Wiss. Krakau, 1898, No. 7, pp. 312–317*).

Notes on the evergreen and the periodically deciduous trees of Java, S. H. KOORDERS (*Forstl. Naturw. Ztschr., 7 (1898), No. 11, pp. 357–373, pls. 5*).

On the resistance of fir trees to smoke, etc., H. WISLICENUS (*Tharand. Forst. Jahrb., 48 (1898), pp. 152–172*).

On the shrinking and swelling of wood, D. KITAO (*Col. Agr. Tokyo, 3 (1898), No. 4, pp. 299–370, pls. 9*).—A study of the rate of shrinking and swelling of timber is given, and numerous formulas for determining the same are given.

Investigations in the bark of trees, T. MEEHAN (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 511–523, figs. 7*).—Reprint of Bulletin 29 (E. S. R., 9, p. 812).

Structure of the wood of the Pomaceæ, A. BURGERSTEIN (*Sitzber. Math. Naturw. Cl. K. Akad. Wiss. [Vienna], 107 (1898), Nos. 1–4, pp. 8–22*).

The walnut and its culture, P. MOUILLEFERT (*Prog. Agr. et Vit., 30 (1898), No. 52, pp. 774–776, figs. 14*).—Gives brief illustrated notes on varieties of walnuts, and notes some of their diseases, the principal of which are *Marsonia juglandis*, *Polyporus sulphureus*, and *Agaricus melleus*.

History of a communal forest, E. PICARD (*Mem. Acad. Sci. Arts et Belles-Lettres Dijon, 4. ser., 6 (1898), pp. VII + 301*).—Describes the Crochères forests and the town of Auxonne.

Concerning the estimation of the quantity of standing timber, K. BÖHMERLE (*Centbl. Gesam. Forstw. Wien, 24 (1898), No. 12, pp. 519–531*).

The nomenclature of the Nebraska forest trees, C. E. BESSEY (*Proc. Nebraska Acad. Sci., 6, 1896, pp. 229–237*).—The author gives a list of the generally accepted scientific names of the 67 species of trees growing in the State.

SEEDS—WEEDS.

Test of beet seed, E. WALKER (*South Carolina Sta. Bul. 34, pp. 7–9*).—A report is given of investigations made to test the relative value of large and small beet seed. Of the various lots of seed as purchased about 40 per cent were large and plump, while 60 per cent were small, poorly developed, and more or less imperfect. The seed which were grown in shallow boxes were pressed uniformly into the soil and then covered with fine sand. One lot of the seeds was soaked for 5 hours in warm water, while the other was planted dry. The germination of the different lots of large and small beet seed is shown in the following table:

Germination of large and small beet seed.

	Large seed.				Small seed.			
	Third day.	Fifth day.	Eighth day.	Total 8 days.	Third day.	Fifth day.	Eighth day.	Total 8 days.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Dry sown	50	25	7	82	23	12	7	42
Soaked	64	8	1	72	9	4	5	18

In conclusion the author states that large seed is to be much preferred, since it gives a larger percentage of germination as well as stronger

plants. The experiment also showed that there was no advantage in soaking beet seed prior to sowing, but in this case there was an actual loss amounting to about 18 per cent.

The effect of fertilizers on the germination of seeds, G. H. HICKS (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 428, 429*).—A report is made upon a series of tests on the effect of various chemical fertilizers on seeds of wheat, lettuce, radish, and crimson clover. The author's conclusions are as follows:

"One per cent strengths of muriate of potash and sodium nitrate used as fertilizers are very detrimental to the germination of seeds, whether applied directly or mixed with the soil. Fertilizers composed of phosphoric acid or lime are much less injurious to germination than sodium nitrate or muriate of potash, and if not used in excess may be harmless. Commercial fertilizers should not be brought into direct contact with germinating seeds. The effect of treating seeds with chemicals before planting is no index to the action of those chemicals when applied as manures to the soil. The chief injury from chemical fertilizers is effected upon the young sprouts after they leave the seed coat and before they emerge from the soil, while the seeds themselves are injured only slightly or not at all. It is highly improbable that potash, phosphoric acid, nitrogen, or lime used as fertilizers actually favor germination."

On the influence of humus acids on germination, R. TOLF (*Tidskr. Landtmän, 19 (1898), No. 22, pp. 387–390*).—In order to study the effect of free humic and ulmic acids on germination the author filled four germination dishes with sand sterilized by ignition, moistening the sand with distilled water. Four other dishes were filled with raw, wholly undecomposed, but previously finely pulverized peat. The latter was taken 0.5 meter below the surface of a drained marsh and near a ditch, so that its water content was not excessive: the sand in every case contained more water after having been moistened than did the peat. This was a typical Smaland high-marsh peat, made up exclusively of *Sphagnum fuscum* and *Eriophorum vaginatum*, and had a decided acid reaction. Four other dishes were filled with peat in which the free acids had been barely neutralized with chalk.

In each of the 3 sets of germination dishes, prepared as described, series of 100 seeds each of spring wheat, plumage barley, mammoth spring oats, and Probster oats (outer seeds only) were sown, and kept at a temperature of 18 to 20° C. for 5 days. At the end of this period the lengths of the radical and the rootlet of each plant were carefully measured and the plants critically examined. The average results are shown below:

Effect of humus acids on germination.

Kind of seed.	Average length of radical.			Average length of rootlets.		
	Sand.	Raw peat.	Neutralized peat.	Sand.	Raw peat.	Neutralized peat.
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Wheat	29.5	13.4	36.3	158.7	36.9	163.1
Barley	41.8	20.6	39.7	223.6	77.0	250.6
Rye	38.8	23.5	41.4	205.2	59.0	198.7
Oats	*a* 30.4	*b* 14.1	*a* 29.9	137.5	45.4	149.5

a All radicals expelled. *b* 36 per cent lacked the power to expel the radical.

The deleterious influence of free humus acids on germination is strikingly shown by the results given in the table. The rootlets of grains sown in humus soils invariably presented an abnormal appearance, both as regards position, number, and shape, and the root tips appeared brown, scorched, and shriveled, separated from the rootlet itself by a partition. The proper treatment of humus soils includes liming, admixture of sand, and good tillage.—F. W. WOLL.

The Russian thistle, L. H. PAMMEL (*Iowa Sta. Bul. 38, pp. 24, pls. 4, figs. 3*).—The present bulletin is issued as supplementary to Bulletin 26 of the station (E. S. R., 6, p. 551). Since the previous bulletin was issued sufficient information has accumulated on which to base some opinion as to the aggressive character of the weed. The present distribution in Iowa embraces 48 stations; but the author thinks that on account of the fact that cultivated crops are so extensively grown in the State the weed will never become as noxious as many other species. Notes are given on the character of the plant, its distribution, methods of eradication, and its forage value, together with a partial bibliography of station and department publications relative to it.

Sixth report on Kansas weeds, A. S. HITCHCOCK and G. L. CLOTHIER (*Kansas Sta. Bul. 80, pp. 113–164, pls. 16*).—In Bulletin 57 of the station (E. S. R., 8, p. 409) the authors give a descriptive list with distribution of the weeds of the State, but since that time many notes and observations have accumulated and it is thought desirable to issue a new bulletin showing the distribution of weeds throughout the State. As in the previous bulletin, the distribution of the different species is indicated by maps in which a dot indicates the presence of an authentic specimen from the different counties of the State. In the present bulletin 209 species are described, 80 of which are included in the list designated as bad weeds. While other species than those enumerated may be troublesome in some localities, yet from several years experience it is thought that for the State as a whole the list would be confined to the species enumerated. Of the 80 bad weeds 23 are perennial, 7 biennial, and the remainder annuals, several of which are so-called winter annuals. Of the total list of weeds enumerated 149 species are native to the State, and of the list of bad weeds one-half are native plants, and among these are many of the worst. The distribution throughout the United States of the 80 weeds classed as most troublesome is also given.

The methods by which weed seeds are scattered are discussed at some length, the principal agents mentioned being wind, animals, automatic movements, railroads, and the use of impure grass, grain, and vegetable seeds, etc.

In 1893 a plat 10 ft. square was marked off on the station ground and a record kept of the seedling weeds which were removed from time to time. This has been continued for several years and the record for 1893–1897 is given.

Notes are given on the number of seeds produced by some weeds, the author having determined approximately the number of seeds produced by a single plant of some of the more common weeds. The following table shows the approximate number of seed produced by some of the worst weeds:

Number of weed seed produced by a single plant.

Species.	Number.	Species.	Number.
Portulaca oleracea	69,000	*Amarantus albus*	14,000
Abutilon avicennæ	31,900	*Amarantus blitoides*	155,000
Hibiscus trionum	43,300	*Acnida tuberculata*	945,000
Ambrosia artemisiæfolia	23,100	*Cycloloma platyphyllum*	357,600
Xanthium canadense	9,700	*Euphorbia marginata*	21,900
Bidens frondosa	10,500	*Panicum sanguinale*	89,600
Martynia proboscidea	8,000	*Setaria glauca*	113,600
Salvia lanceolata	1,900	*Cenchrus tribuloides*	42,700
Amarantus retroflexus	85,000	*Eragrostis major*	140,000

The authors have made some investigations relative to the fertilization of flowers and have found that the following are dependent on insect visits: *Portulaca oleracea*, *Ipomœa hederacea*, *I. purpurea*, *Solanum rostratum*, and *Euphorbia maculata*. The following species are self-fertile: *Abutilon avicennæ*, *Hibiscus trionum*, *Iva ciliata*, *Bidens frondosa*, *Amarantus retroflexus*, *Acnida tuberculata*, *Chenopodium album*, *Phytolacca decandra*, *Polygonum pennsylvanicum* (seed smaller than average), *Euphorbia marginata*, *Panicum sanguinale*, *Setaria glauca*, and *Eragrostis major*.

The authors discuss the subject of the eradication of weeds and give a list with descriptive notes of 209 species.

Massachusetts weeds, G. E. STONE (*Agr. Massachusetts, 1897, pp. 268–277*).—A popular article on the dissemination, distribution, and eradication of weeds.

A new wild lettuce from New England, B. L. ROBINSON (*Rhodora, 1 (1899), No. 1, pp. 12, 13, pl. 1*).—The author describes *Lactuca morssii* from Massachusetts. It somewhat resembles *L. canadensis* and *L. leucophæa*.

Matricaria discoidea in eastern Massachusetts, W. H. MANNING (*Rhodora, 1 (1899), No. 1, p. 18*).—The occurrence of this weed at several stations is noted and it is said to be apparently driving out the common mayweed, *Anthemis cotula*.

On the destruction of orobanche on clover, A. LONAY (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 38*).

DISEASES OF PLANTS.

Report of the botanist, G. E. STONE and R. E. SMITH (*Massachusetts Hatch Sta. Rpt. 1897, pp. 47–70, pls. 2*).—The authors give a brief review of the work conducted during the past year and report more at length upon some of the particular lines of investigation.

The causes of the failure of the potato crop of 1897 were investigated. Among other causes may be mentioned the extremely wet condition of the soil at planting time, which is thought to have induced the rotting of the stems of the young plants just below the ground. The authors

do not consider this a specific disease of the potato nor do they think any treatment necessary. About the middle of July several extremely hot, sunny days following a long rainy period occurred, and in many potato fields on low ground the plants began to wilt. Investigation of the plants showed that there was no one organism, with possibly the exception of bacteria, affecting the plants, but there was a general rotting resulting from the wet condition of the soil and the consequent low vitality of the plants. This trouble was considered to be due to abnormal weather conditions, and when the potatoes had reached a marketable size the authors recommended digging them to prevent decay.

In August the potato blight or rot due to *Phytophthora infestans* appeared and spread extensively.

The drop of lettuce caused by *Botrytis* sp. is discussed at some length, and suggestions are given for the sterilization of soil in greenhouses by steam or other means. Steam sterilization is thought to be the most promising. Various methods of treatment for this disease are being investigated, and it is said to be desirable to ascertain how deep the soil should be sterilized in order to keep down the fungus.

Notes are given on asparagus rust and the possibility of checking it by cutting and burning the plants is discussed. Several instances are cited in which cutting, which was extensively practiced in the season of 1897, seemed to be almost entirely without effect, the rust appearing quite badly on the second growth. The experience of another season is said to be necessary to demonstrate the effect and seriousness of this disease.

The authors briefly discuss the fire blight of pear, quince, and apple due to *Micrococcus amylovorus*, quince rust caused by *Gymnosporangium clavipes*, the brown rot of stone fruits due to *Monilia fructigena*, and chrysanthemum rust caused by *Puccinia tanaceti*. In reference to the last-named disease they state that great care should be exercised in selecting cuttings from vigorous plants unaffected by rust, and that spraying with Bordeaux mixture or a potassium sulphid solution will probably prove profitable. Several other diseases affecting the leaves of chrysanthemums are noted, but the discoloration of the leaves affected by the rust will distinguish them. In the case of the rust there is a production of numerous small pustules on the under side of the leaf which contain a dark red powdery substance similar to carnation rust.

A disease of the cultivated geranium is briefly described, which is characterized by the leaves turning yellow in small spots which gradually increase in size, the leaf tissue dying away at these points. The dead spots spread until finally the leaves lose their vitality completely. All varieties are equally affected. The disease is reported from several localities in the State. The injury seemed to be the result of an attack of some fungus, but investigation of infected leaves failed to reveal any specific organism. Plants sprayed with

Bordeaux mixture gave no appreciable immunity. The authors do not consider this a genuine disease, but state that it is probably due to low vitality and hindered growth, caused by excessive moisture.

Brief notes are given on leaf blights of native trees. Among those described are the following: Leaf blight of sycamore (*Glœsporium nervisequum*), leaf blight of butternut (*G. juglandis*), leaf spot of chestnut (*Septoria ochroleuca*), and leaf spot of wild black cherry (*S. cerasina*).

A bacterial disease of beets, PRILLIEUX and DELACROIX (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 6, pp. 338, 339*).—For several years there has been noticed in the north of France and in the vicinity of Paris a disease of beets, to which the name "yellows" (*jaunisse*) has been given. This disease seems to appear on soil where seed beets have been grown, and makes its appearance between the 1st and 15th of July. At first the leaves lose their normal turgescence, the petioles become less rigid, and the tip of the leaf turns down. At the same time the leaves become finely variegated green and white, as is the case in the mosaic disease of tobacco. This appearance is more noticeable by transmitted light, the discolored portions, especially in the young leaves, being translucent. With the progress of the disease the discolored spots coalesce and the leaf dries up; at this time the color varies from yellow to gray. When plants are severely attacked the roots do not increase much in size, although retaining their normal sugar content, and the total loss of the crop is about 50 per cent. If the diseased beets are planted for seed in the spring, the leaves which appear will show the pathological characters which have been enumerated. Under the microscope the diseased areas show great numbers of short, curved bacteria, which rapidly render the liquid contents of the cell turbid. The chlorophyll bodies of the cell are discolored and the granules in the cells become more refractive and are more apparent than in sound leaves. When mother beets are attacked by the bacteria, not only the leaves but the floral bracts and calyx are attacked, and it seems probable that the bacteria are able to persist, probably in the state of spores, in the fruit of the beet.

Experiments have been conducted to test the artificial infection of beets with this disease with marked success. Three rows of beets were seeded in sterilized soil and transplanted to a soil in which beets had not been grown. One row was watered with a diluted pure culture of the bacteria and in a few days the characteristics of the disease appeared, while the others remained absolutely unaffected.

In the second experiment dried leaves from diseased plants were powdered and mixed with the soil in the garden in April. Young beets were transplanted to the soil and, except when planted in the soil receiving the powdered leaves, there was no appearance of disease. The authors consider it established that this disease is due to bacteria, and further study under the direction of the minister of agriculture is contemplated.

Concerning a root disease of wheat, L. MANGIN (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 5, pp. 286–288*).—The author gives a report on a disease of wheat known in France since 1878, which has been generally attributed to *Ophiobolus graminis* (E. S. R., 9, p. 1057). This fungus is said to develop principally on the leaf sheaths and rarely on the culm or roots. The author states that he has found associated with it *Leptosphæria herpotrichoides*. The effect of both these fungi on the wheat plant was shown, and their parasitism seems well established. Other species of fungi that have from time to time been reported as associated with them are said to be saprophytic, and are not directly concerned in producing the disease in question. A report is given on a series of inoculation experiments carried on with the fungi, from which it appears that both parasites are found in the lower internodes, while Ophiobolus sometimes occurs on the roots. They are capable of producing diseased conditions of the culm, weakening it and greatly reducing the total harvest. The rigidity of the culms is influenced somewhat differently by the different fungi, the Leptosphæria probably causing the most damage. As a result of the invasion of the fungi the culms take a peculiarly twisted condition, and the harvest is diminished not only on account of the presence of the parasite, but because the twisting restricts to some extent the circulation in the plants and exposes the weakened plants to attacks of numerous parasites and saprophytes.

The asparagus rust: Its treatment and natural enemies, B. D. HALSTED (*New Jersey Stas. Bul. 129, pp. 20, pls. 2*).—A brief sketch is given of the history and distribution of asparagus rust which before 1896 was only known to occur in this country in California. Since that time it has spread extensively and it now seems to occur throughout New England and the Atlantic Coast region as far south as South Carolina. The interior and western part of the United States seems as yet to be free from the rust and it has not been reported for a number of years in California.

When the asparagus field is badly affected with the rust, the general appearance of the plants is that of unusual early maturity. Instead of the healthy green color the plants are of a brownish hue, as though insects had sapped them or frost destroyed their vitality. A close examination shows the characteristic appearance of the rust, and all its stages are borne upon the same host.

Experiments were conducted to test the value of spraying plants with Bordeaux and similar fungicides for the prevention of the rust. A number of plants were selected and 10 applications given at a total cost of $4.59, or at the rate of $21.76 per acre.

The result of the application of fungicides seemed to indicate a reduction of the disease amounting to about 25 per cent. The author recommends the autumn treatment of the fields, which consists of burning old brush, either as it stands in the field or by cutting and burning in

piles. The latter method, however, is thought to be hardly as efficient as the former on account of the fact that many spores will be scattered in the cutting and piling. It is thought that a thin coat of lime sprinkled over the ground and left there during the winter will also prove beneficial in destroying those spores which may have found lodgment on the soil.

Two fungus enemies are described which attack the asparagus rust and may, to some extent, help hold it in check. These are *Darluca filum* and *Tubercularia persicina.*

The author gives briefly a summary of the literature relating to asparagus rust in the United States.

Briefly summarizing the conclusions, it is stated that the asparagus fungus (*Puccinia asparagi*) was described as early as 1805 and is generally distributed throughout Europe. Aecidial, Uredo, and Teleutosporic forms are all found on the asparagus plant. Spraying experiments with Bordeaux and similar fungicides reduced the amount of rust about one-fourth. Among the varieties tested Palmetto proved less susceptible than others. The pistillate plants also appear less subject to attack than the staminate ones. This rust is found on other species of asparagus, but so far is not known to occur on any wild plants or weeds other than asparagus.

Experiments in combating the rose rust in 1898, K. MOHR (*Rosen Ztg., 13 (1898), No. 5, pp. 79, 80*).—The occurrence of the rose rust on quite a number of varieties of roses during the summer of 1898, led the author to conduct a series of experiments for the prevention of the disease. It was successfully combated by spraying the plants with a mixture composed of 9 liters of limewater and $\frac{3}{4}$ liter Sulfurin. The limewater was formed by slaking quicklime and thoroughly stirring it before using. After mixing with the Sulfurin the mixture is allowed to settle and the clear liquid is sprayed upon the plants. Investigations made from time to time during the season on some of the more susceptible varieties showed that where the plants had been sprayed no rust was present, while upon the unsprayed ones the disease was very abundant. In spraying the roses particular pains must be taken to spray both surfaces of the leaf, as well as to apply it thoroughly to the stems of the plants. The author states that the same mixture is also very beneficial in combating the rust of mallows (*Puccinia malvacearum*).

Concerning the adherence of copper compounds which are used in combating diseases of the grape, G. M. GUILLON and G. GOUIRAND (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 4, pp. 254–256; 11, pp. 423, 424*).—The authors have investigated the subject of the adherence of different fungicides, making a study of the following: (1) Bordeaux mixture, composed of 2 per cent of copper sulphate and sufficient lime to render the mixture slightly alkaline; (2) the same with the addition of 1 per cent molasses; (3) the same with the addition of 0.3 per cent gelatin; (4) mixture of 2 per cent copper sulphate and 3

per cent carbonate of soda; (5) a solution of 2 per cent copper sulphate and 3 per cent of bicarbonate of soda; (6) 2 per cent copper sulphate and 3 per cent soap; (7) 2 per cent copper sulphate and 3 per cent carbonate of potash; (8) 2 per cent copper sulphate and 3 per cent carbonate of ammonia; (9) eau celeste, to which sufficient ammonia is added to render the solution slightly alkaline; (10) 2 per cent solution of copper acetate, and (11) neutral acetate of copper.

The method of distinguishing the adherence of these different fungicides was to place small quantities of the liquid on glass plates which had been previously washed with alcohol, and after drying them in the sun subject them to an artificial rain; the liquid remaining on the plate was tested for copper immediately after its deposit, also 2 and 24 hours later. At the expiration of 24 hours the Bordeaux mixtures were the most adherent, followed closely by the mixture composed of copper sulphate and carbonate of potash and eau celeste. Some of the other fungicides had been completely washed off at the end of 24 hours.

The experiments were repeated, the plates being exposed to natural rain with results analogous to those above. From the authors' experiments it seems that acid Bordeaux mixture is less adherent than basic, and basic still less than neutral Bordeaux mixture. The same applies to fungicides containing carbonate of soda. When molasses is added to the mixture in general they are less adherent, and the more molasses added the less the adhesive power. The same applies equally to gelatin.

In a series of experiments reported later the authors tested the adherence of the same fungicides on grape leaves under the same conditions as previously given. In the case of the latter experiments they concluded that in general fungicides as used were less adherent than those prepared under the earlier formulas. The difference in the case of the adhesive power of Bordeaux mixture was not very great, but in the case of those fungicides containing soda, soap, or ammonia, it was greatly affected by the method of preparation used. In conclusion the authors state that fungicides to be most adherent to grape foliage, especially those containing soda or soap, ought to be employed immediately after their preparation.

Based upon their adhesiveness the fungicides may be arranged in the following order: (1) those containing soap; (2) bicarbonate of soda; (3) carbonate of soda; (4) Bordeaux mixture, carbonate of potash, eau celeste, and acetate of copper; (5) gelatin; (6) molasses, and (7) neutral acetate of copper. In general all these fungicides are most adherent the nearer neutral they are made.

The brulure of flax, E. MARCHAL (*Bul. Soc. Belg. Micros.*, 22 (1898), pp. 125, 126).—This disease, which results in the etiolation of the plants, is said to be due to *Asterocystis radicis*.

A clover fungus (*Jour. Bd. Agr.* [*London*], 5 (1898), No. 1, pp. 37–50, figs 2).—Illustrated notes are given of *Sclerotinia trifoliorum*.

Protection against canker of white fir, HECK (*Forstl. Naturw. Ztschr.*, 7 (1898),

No. 10, pp. 344–347).—Notes the distribution and methods of attack and suggests means for the prevention of *Agaricus adiposus* and *Polyporus hartigii*.

Notes on apple canker, W. PADDOCK (*Science, n. ser., 8 (1898), No. 206, pp. 836, 837*).—It is stated that *Sphæropsis malorum* is in all probability parasitic on the wood of the pear and quince as well as upon the apple. Inoculations made from cultures from the 3 kinds of wood produced diseased fruits in every case.

Some important pear diseases, B. M. DUGGAR (*New York Cornell Sta. Rpt. 1898, pp. 596–627, figs. 16, dgm. 1*).—A reprint of Bulletin 145 of the station (E. S. R., 10, p. 450).

The lily disease (*Amer. Gard., 19 (1898), No. 210, p. 803*).—The views of Peter Barr on the cause of the lily disease are given, in which it is attributed to weakness of plants, due to exhausted condition of Bermuda soils where bulbs are grown. American and Holland bulbs are expected to be free from this trouble.

A new disease of cultivated palms, W. TRELEASE (*Rpt. Missouri Bot. Gardens, 9 (1898), p. 159, fig. 1*).—*Exosporium palmivorum*, a new species by Saccardo, is figured and described as the cause of a disease of *Phœnix canariensis*, *P. tenuis*, and *P. reclinata*.

Fungus and insect pests of the red beech in the Alsacian forests, STROHMEYER (*Forstl. Naturw. Ztschr., 7 (1898), No. 9, pp. 316–319*).

Distribution of potato diseases in Germany, FRANK (*Deut. Landw. Presse, 25 (1898), No. 32, pp. 347, 348; abs. in Bot. Centbl., 76 (1898), No. 1, pp. 26, 27*).—Diseases due to Phytophthora, Rhizoctonia, Phellomyces, and the bacterial diseases are said to be generally distributed throughout the country. Fusarium is not found in Brandenburg nor in the Kingdom of Saxony. Nematodes are reported as particularly destructive in 9 states and provinces. A considerable variation in resistance of varieties to disease is also reported.

Some observations bearing upon the symbiotic mycoplasm theory of grain rusts, H. L. BOLLEY (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 408*).—The author reviews the work of Eriksson relative to the rusts of cereal grains and other grasses. He dissents from the view given by Eriksson that there is any indication of a mycoplasm infection. The author gave an outline of experiments in which he grew cereals to maturity in rust-proof cages without any infection whatever, although every plant close by bore numerous pustules. Incidentally it is stated that the germ tubes of the uredo-spores may enter not only by way of the stomata, but also directly through the cuticle of wheat and oat plants.

The smuts and blights of cereals, E. THOMAS (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 38*.

Chrysanthemum rust, G. ABBEY (*Jour. Hort., 50 (1898), No. 2611, pp. 284, 285, figs. 2*).—The uredo and puccinia forms of this rust are figured and described. The author thinks the method resorted to in forcing the plants is largely responsible for the disease. Bordeaux mixture is recommended as an efficient fungicide. Washing the plants with a permanganate of potash solution is also mentioned as an effective treatment.

Twig galls of the pine, K. VON TUBEUF (*Forstl. Naturw. Ztschr., 7 (1898), No. 9, p. 321*).

Parasites of the willow, E. CROUZEL (*Les parasites du saule. Paris: Soc. d'Edit. Scientifiques, 1898, pp. 36*) —Treats briefly of the principal fungus and insect pests of willows, with means for their prevention.

Some coffee pests, A. ZIMMERMANN (*Teysmannia, 9 (1898), No. 9–10, pp. 402–421*).—In an address before the Coffee Congress at Malang the author mentioned some of the more destructive enemies of coffee culture, among them being nematodes, *Tylenchus coffeæ* being especially troublesome.

The influence of potash fertilizers on "beet sickness," M. HOLLRUNG (*Ztschr. Ver. Deut. Zuckerind., 1898, pp. 343; abs. in Bot. Centbl., 76 (1898), No. 7, pp. 243, 244*).—The author concludes, from an extensive series of experiments, that potassium carbonate, and especially potassium magnesium carbonate, exert a favorable influence in correcting "beet sickness" of soils.

ENTOMOLOGY.

House flies, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Circ. 35, 2. ser., pp. 8, figs. 6*).—The difference between house flies and several related species is briefly pointed out. The eggs, about 120 for each individual, are usually laid upon horse manure. One-fourth pound horse manure, taken from a pile of manure in August, contained 160 larvæ and 146 puparia. Larvæ are not found in perhaps the greater part of ordinary horse-manure piles, but in one case about 200 puparia were found in less than 1 cu. in. of manure.

"The periods of development were found to be about as follows: Eggs from deposition to hatching, one-third of a day; hatching of larva to first molt, 1 day; second molt to pupation, 3 days; pupation to issuing of the adult, 5 days; total life round, approximately, 10 days. There is thus abundance of time for the development of 12 or 13 generations in the climate of Washington every summer."

Experiments were conducted during 1897 and 1898 to determine whether a manure pile could be treated to stop the breeding of house flies.

"It was found to be perfectly impractical to use air-slaked lime, land plaster, or gas lime with good results. Few or no larvæ were killed by a thorough mixing of the manure with any of these three substances. Chlorid of lime, however, was found to be an excellent maggot killer. Where 1 lb. of chlorid of lime was mixed with 8 qt. of horse manure 90 per cent of the maggots were killed in less than 24 hours. At the rate of a quarter of a pound of chlorid of lime to 8 qt. of manure, however, the substance was found not to be sufficiently strong. [This, however, is considered too expensive for practical use.] It was found that 8 qt. of fresh horse manure sprayed with 1 pt. of kerosene, which was afterwards washed down with 1 qt. of water, was thoroughly rid of living maggots. Every individual was killed by the treatment."

This remedy did not prove entirely satisfactory when employed on a large scale. An attempt to prevent the breeding of house flies in a pile of manure was begun early in April, 1898, and continued for some time.

"While undoubtedly hundreds of thousands of flies were destroyed in the course of this work, it was found by the end of May that it was far from perfect, since used at an economical rate the kerosene could not be made to penetrate throughout the whole pile of manure, even when copiously washed down with water. A considerable portion of house-fly larvæ escaped injury from this treatment, which at the same time was found, even at an economical cost, to be laborious, and such a measure in fact as almost no one could be induced to practically adopt."

A measure which proved very successful was to place the manure collected each morning in a closet, the window of which was provided with a wire screen, and to scatter a small shovelful of chlorid of lime over it.

House ants, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 34, 2. ser., pp. 4, figs. 3*).—The habits, life histories, and characteristics of the red ant (*Monomorium pharaonis*) and the pavement ant (*Tetramorium cæspitum*) are given and other species are noted.

The possibility of driving ants away by the use of gum camphor is

noted. Where the nests can be located, whole colonies may be destroyed by pouring an ounce or two of carbon bisulphid into a number of holes made in the nest with a stick and promptly closing the holes with the foot.

"Whenever the nests of any of these ants can not be located, there is no other resource than the temporary expedient of destroying them wherever they occur in the house. The best means of effecting this end is to attract them to small bits of sponge moistened with sweetened water and placed in the situations where they are most numerous. These sponges may be collected several times daily and the ants swarming in them destroyed by immersion in hot water. It is reported also that a sirup made by dissolving borax and sugar in boiling water will effect the destruction of the ants readily and in numbers. The removal of the attracting substances, wherever practicable, should always be the first step."

The true clothes moths, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 36, 2. ser., pp. 8, figs. 3*).—The case-making clothes moth (*Tinea pellionella*), the webbing or southern clothes moth (*Tineola biselliella*), and the tapestry moth (*Trichophaga tapetzella*) are described and their life histories and habits are briefly given. The remedies usually employed are noted, namely, beating, shaking, or brushing the articles affected, exposing them to air and sunlight, the use of various repellants, such as tobacco, camphor, naphthaline, cedar chips, tarred paper, etc. Articles which are free from the insects may be kept so by inclosing them in tight bags of cotton or linen cloth or strong paper. Cold storage can be successfully used to prevent injury from clothes moths. Tests made at Washington demonstrated that a temperature maintained at 40° F. renders these insects dormant and is thoroughly effective. The larvæ are not killed even at a steady temperature of 18° F., but an alternation of a low temperature with a comparatively high one invariably results in their death.

The larger apple-tree borers, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Circ. 32, 2. ser., pp. 12, figs. 3*).—The round-headed apple-tree borer (*Saperda candida*), the spotted apple-tree borer (*S. cretata*), and flat-headed apple-tree borer (*Chrysobothris femorata*) are described and their distribution, food habits, life history, methods of attack, and natural enemies are given.

The methods of controlling the round-headed apple-tree borer are to practice clean culture, cut the larvæ out of the tree, kill them by applying kerosene wherever their castings are seen protruding through the bark, or prevent their entrance by means of impenetrable substances, such as paper and hydraulic cement, or by repellant washes made from fish oil or soft soap, with the addition of caustic potash or washing soda carbolated with carbolic acid.

The remedies are the same for the spotted and flat-headed apple-tree borers as for the round-headed borers, except that for the flat-headed borer the coverings and washes should be applied farther up the tree trunks and branches, and that trap wood may be used. It is suggested that limbs and trunks of newly felled trees which the borers attack,

such as oak, maple, and young fruit trees, be distributed on the outskirts of the orchard, where they should be freely exposed to the sun so that the beetles will deposit their eggs on them. This trap wood should then be destroyed before the beetles emerge the following spring.

The peach borer—experiments with hydraulic cement, J. B. SMITH (*New Jersey Stas. Bul. 128, pp. 28, figs. 7*).—The peach-tree borer (*Sanninoidea exitiosa*) is well known to peach growers and causes considerable loss annually. In general orchards on light soils are said to suffer more than those on heavy soils, while in some stony orchards the trees are almost exempt. Many methods of prevention, some of them effective, have been proposed to prevent injury, and the author determined upon a series of experiments in 1897 partly to test some of the applications themselves and partly to discover the reason for contradictory results. It was discovered at the outset that there was a great lack of definiteness in our knowledge of the life history of the insect and that statements heretofore made, while mostly true, were lacking in completeness. On this account a rather full study of the early stages of the insect was made and the earlier published accounts of Say and others reviewed.

It appears that the larva becomes full grown some time between the last of May and the first of August. It forms a cocoon of sawdust, excrement, and silk, in which it changes to a pupa. The moths begin to emerge some time during the latter part of June and continue until the first days of September. The sexes are produced in about equal numbers, copulate soon after issuance, the female beginning to lay eggs immediately thereafter, placing them anywhere on the trunk and even on the branches 5 ft. or more from the ground. The eggs never seem to be deposited at the surface of the ground or very close to it, but will mostly be found 6 to 18 in. above the ground. The adult life is short, perhaps only a day or two, and the female lays in that time between 500 and 600 eggs. The egg period is said to be probably 7 to 10 days and the young larvæ may crawl or bore almost anywhere, but sooner or later work their way to the base of the tree, where they may be found from the surface to 18 in. underground. The winter is passed in the larval stage in the tree and growth is resumed in the spring until ready for pupation. About the middle of July all stages, from egg to adult, may be found in a badly infested orchard. These dates apply only to New Jersey and Long Island.

A rather comprehensive description of the insect is given in which it is stated that the caterpillars are white, except the head and part of the first segment, which are yellowish and become brown. Along the sides is a series of almost round yellowish dots, and scattered over the surface, arising from definitely arranged smooth warts, are short, stiff, bristly hairs, more prominent in young than in the mature larva. The anal end of the larva is also brown. The caterpillar changes little

in appearance as it grows, but becomes stouter and is known as a fat, white worm or grub. The larvæ from which males are produced are smaller than those producing females. The cocoon and pupa are described as well as the mature insect. The male moth is said to be of a steel-blue, almost black color, with a narrow yellow collar and narrow yellow bands on the abdomen, giving it a decided wasp-like appearance. The female is larger, more heavily built, bluish in color, and has a broad orange band about the middle of the abdomen by which it can be readily recognized.

The injuries caused by the borers are described. No peach tree seems to be safe from attack. When the borers once get into the tree there is nothing to do but cut them out. The principal treatment is a preventive one. The experiments were made in the protection of the trees with newspapers, waxed heavy paper, heavy manila wrapping paper, tar paper, tile tree protectors, wooden box protectors, hydraulic cement and skim milk, hydraulic cement and water, Bordeaux mixture with an excess of lime, and wrapping with wire netting. All covers were extended at least 12 in. above and 2 in. below the ground. The experiments were carried out in a number of orchards and the detailed reports are given. The experiments show that wrapping the trees with double thickness of newspapers so that at least 15 in. of the trunk above ground is covered is one of the most efficient methods. When the wrappings are taken off, which should be done about the middle of September, the trees should be closely examined, and if any borers have made their way in above the paper they should be cut out. The paper wrapping should be put on the trees every year not later than the first week in June. In tying on the papers too strong or stiff twine should not be used, since peach trees grow rapidly and may become girdled unless the twine is somewhat yielding and breaks under a moderate strain.

The experiments conducted with hydraulic cement were quite successful, and the author recommends a mixture of cement and skim milk to be applied to the tree trunks. This forms a continuous coating that will remain in good condition during the entire summer. It does not appear to produce any injury whatever, is impenetrable to young larval insects, and such a surface would not be selected by the adult for oviposition. The coating is said to be sufficiently elastic to admit of moderate growth and quite brittle enough to break readily from efforts of any insects to get out from beneath the bark. It would not therefore prevent the exit of borers that are already working in the tree, but would keep out young larvæ attempting to get in.

The author thinks probably this cement added to some of the soap washes used by fruit growers would improve their lasting qualities. The water and cement mixture was so far inferior to that made with skim milk that its use is not recommended. In all cases the cement should be broken up with a stiff brush when the danger season is over.

On young trees it should not be put on until necessary or kept on longer than required, so that the bark may develop normally. On old trees it is said to make little difference when the application is made.

The striped cucumber beetle, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Circ. 31, 2. ser., pp. 7, figs. 2*).—This is a popular circular giving general appearances and nature of attack of the striped cucumber beetle, its food plants, life history and habits, and remedies for it. The injury is due to the "direct attack by the beetles to the plant above ground; indirectly to the beetles as transmitters of disease germs; and to the larvæ working upon the roots underground." The larvæ are thought to be restricted to cucurbitaceous plants but the beetles feed on many cultivated plants such as beans, peas, apple blossoms, ripe apples; the leaves, silk, pollen, and unripe kernels of corn, and on such wild plants as golden-rod, aster, the flowers of choke cherry, juneberry, cherry, and other rosaceous plants; the stamens, pistils, and ray flowers of sunflowers, and probably other composites. The wild cucumber (*Echinocystis lobata*) is not only attacked by the beetles but is probably also a larval food plant. Among the remedies noted are covering the young plants, early planting, clean culture, stimulating growth, the use of trap plants, slaked lime, arsenites with ashes, dust, or plaster, land plaster saturated with kerosene or turpentine, etc.

Three injurious insects, A. L. QUAINTANCE (*Florida Sta. Bul. 45, pp. 53-74, pls. 3*).—The author describes the bean-leaf roller (*Eudamus proteus*), the corn delphax (*Delaphax maidis*) and the canna-leaf roller (*Hydrocampa cannalis*).

The bean-leaf roller has been quite destructive to beans throughout the State. The larvæ feed upon the leaves, eating holes in them or feeding upon their edges. Descriptions are given of the different stages in the life history of this insect and observations are given on some of the facts established in studying its life cycle. The larvæ were easily bred in the insectary and invariably pupated within a folded leaflet or several leaflets fastened together. The author states that notwithstanding the fact that diligent search has been made he has been unable to find a single pupa in the field and he suspects that this state may possibly be passed in the soil. Considering the life cycle as averaging about 30 days, 8 or 9 broods of this insect would occur during the year, since they appear early in March and at the latitude of the station continue breeding usually through December. The different broods are not distinct as eggs, young and old larvæ, and adults are found in considerable abundance by early summer. In the more southern parts of the State it is believed that the breeding is continuous throughout the year. Both the larvæ and adults move about freely at all times of the day. The use of Paris green in the proportion of 1 lb. to 150 gal. of water, to which is added 1 lb. of quicklime has proved very efficient in treating for this insect and this insecticide does not destroy the foliage of the plant.

The corn delphax has been observed in several localities in the South

and has proved very destructive to corn. It is a sucking insect, feeding on the sap which it sucks from the leaves and stalks, causing them to turn yellow and frequently die. The insect in all its stages is injurious to its host. The eggs are deposited mainly along the midribs of the leaves, in the loose cellular tissue just below the epidermis. In the earlier stages the insects seem to prefer the leaf sheaths or a protected part of the leaf, as where one leaf overlaps another, but after the fourth phase in their life cycle, they occur somewhat promiscuously on the leaf and stem. The egg state is continued for 17 days. From the nymphal state it passes through five stages, which makes the life cycle about 60 days. Technical descriptions are given of the different stages of the insect, and treatment suggested. Where plants are badly infested it will probably be best to burn them. The exact natural food of the insect is not known, but it is believed to be confined probably to grasses, and it seems safe to replant an infested field with almost any other crop than corn or allied crops.

The canna-leaf roller has been noted for the past 3 years in the vicinity of the station and has occasioned serious damage to these plants. The leaves are either rolled up from one side by the larvæ or, as is more frequently the case, the younger leaves are fastened before they have unrolled to any extent. The caterpillars feed in the rolled up leaves, eating out the soft tissue. Notes are given upon the life history of this insect, together with technical descriptions of its various phases. The canna-leaf roller, the author states, can doubtless be controlled by carefully cleaning off and burning the dead plants and trash from the beds during the winter season. The most of the pupæ and larvæ, which pass the winter in these leaves and trash, will thus be destroyed. The rolled up leaves should be watched for in the spring and cut off and burned.

Remedial work against the Mexican cotton-boll weevil, L. O. Howard (*U. S. Dept. Agr., Division of Entomology Circ. 33, 2. ser., pp. 6*).—Work done in Texas by C. H. T. Townsend, when a field agent of the division showed that the cotton-boll weevil is attracted by sweets. Preliminary experiments with confined weevils suggest treatment of overwintered beetles with a mixture of molasses, with one-fourth its volume of arsenic, applied to the volunteer stalks of cotton in the spring when the leaves are beginning to appear, and treatment of young planted cotton with a spray made of white arsenic, $1\frac{3}{4}$ to 2 oz. boiled in 1 gal. of water until thoroughly dissolved, mixed with 2 or 3 gal. of cheap molasses and diluted with 40 gal. of water.

"The careful study of the weevil damage in Texas conducted by the division during the last 3 or 4 years has demonstrated that the prevention of weevil damage is more a question of the adoption of a proper system of cultivation than of remedial or preventive schemes, such as the use of poisons. In other words, it is admitted by intelligent planters everywhere that the presence of the weevil is made possible by a system of culture which admits of the existence of volunteer cotton, and if the methods followed are such as to prevent such volunteer growth the weevil will rarely, if ever, be troublesome."

An account is given of the working of a machine for the collection and destruction of infested cotton-bolls and weevils.

On the effect of soil treatment for the prevention of insect injuries, J. RITZEMA-BOS (*Ztschr. Pflanzenkrank.*, 8 (1898), *No. 2, pp. 113–121*).—The author reports on the use of benzin and carbon bisulphid injected into the soil for the prevention of injuries caused by nematodes and various root-eating insects. The form of injector is described and notes are given from correspondence with quite a number of individuals relative to the use of the same. It is shown that by the injection of benzin and carbon bisulphid into the soil all the injurious insects are destroyed for a considerable distance. An experiment is reported in which carbon bisulphid was injected into the soil of an oat plat, with the result that there was a very material increase both in straw and grain. It is said that oats could not be grown in this soil heretofore on account of the serious attacks of nematodes.

The bee from the earliest times to the present, A. GMELIN (*Die Biene von der Urwelt bis zur Neuzeit. Stuttgart: E. Ulmer, 1899, pp. 83, figs. 11*).—This is a short review of the development of apiculture. It is reprinted from Witzgall's "Das Buch von der Biene."

Apiculture by simple methods, R. HAMMELL (*L'Apiculture par les méthodes simples. Paris: G. Carré et Naud, 1898, pp. 338, pls. 4, figs. 102*).

Tables for the determination of New Mexican bees, T. D. A. COCKERELL (*Bul. Sci. Lab. Denison Univ., 9 (1898), No. 3, pp. 41–73*).

Injurious insects and diseases of the year, P. H. ROLFS (*Proc. Florida Hort. Soc., 1898, pp. 85–93, figs. 15*).—Notes are given on the bean-leaf roller, canna-leaf roller, strawberry pamera, the status of the San José scale and its fungus parasite, bacterial tomato blight, its infection and prevention, and a fungus blight of tomatoes.

Biological studies of plant lice, A. MORDWILKO (*Arb. Zool. Lab. Univ. Warschau, 1898, pp. 20, 27; abs. in Zool. Centbl., 5 (1898), No. 23–24, pp. 808–812*).—Treats of the migration, some of the phases of the life history, polymorphism, etc., of plant lice.

Asphondylia rübsaameni, n. sp., KERTESZ (*Termeszetr. Fuz., 21 (1898), pp. 248–253, fig. 1; abs. in Zool. Centbl., 5 (1898), No. 18–19, p. 618*).—The author describes this new insect from stunted fruits of *Ferula heuffelii*.

The black peach aphis, W. G. JOHNSON (*Maryland Sta. Bul. 55, pp. 137–140, figs. 4*).—The black peach aphis (*Aphis prunicola*) has appeared in some sections of Maryland in unusual numbers. The bulletin calls special attention to the work of this insect and suggests remedies. Of the remedies tried the author has found kerosene emulsion the most successful.

The codling moth, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1898, pp. 421–488, pl. 1, figs. 21*).—A reprint of Bulletin 142 of the station (E. S. R., 10, p. 460).

Cutworms in young tobacco, W. G. JOHNSON (*Maryland Sta. Bul. 55, pp. 141–144, figs. 4*).—A popular account of the habits of some cutworms which attack young tobacco, with suggestions as to remedies. Directions are given for the preparation and use of a poisoned bait made of 50 lbs. wheat bran, 2 qt. molasses, 1 lb. Paris green, and water to make a thick mash.

The elm-leaf beetle in New York State, E. P. FELT (*Bul. New York State Mus., 5 (1898), No. 20, pp. 34, pls. 6, figs. 6*).—The life history of *Galerucella luteola* is given, together with notes on its distribution in the State, natural enemies, and suggested remedies. An extensive bibliography completes the bulletin.

Orange insects and diseases, P. H. ROLFS (*Proc. Florida Hort. Soc., 1898, pp. 34–38, figs. 4*).—The author describes the principal insect and fungus pests of the orange, and directions are given for combating them.

The quince curculio, M. V. SLINGERLAND (*New York Cornell Sta. Rpt. 1898, pp. 695–715, figs. 10*).—A reprint of Bulletin 148 of the station (E. S. R., 10, p. 565).

A review of entomological work on sugar cane in Java, L. ZEHNTNER (*Meded. Proefstat. Oost Java, n. ser., 40, pp. 25; abs. in Zool. Centbl., 5 (1898), No. 23–24, pp. 803, 804*).—The animals injurious to sugar cane are enumerated and suggestions given for combating them. The list includes 9 wild animals, 3 birds, 8 Coleoptera, 29 Lepidoptera, 2 Diptera, 22 Rhynchota, 16 Orthoptera, 3 Termites, 7 Physopoda, 3 Aphides, and 3 worms. A number of new species are described.

Leaf miners of sugar cane, L. ZEHNTNER (*Meded. Proefstat. Oost Java, n. ser., 42, pp. 14, pl. 1; abs. in Zool. Centbl., 5 (1898), No. 23–24, p. 813*).—Studies are given of *Aphanisticus krügeri* and *A. consanguineus.*

Leaf borers of sugar cane in Java, L. ZEHNTNER (*Arch. Java Zuikerind., 1896, No. 16, pp. 12, pl. 1; abs. in Zool. Centbl., 5 (1898), No. 23–24, p. 813*).—Describes *Hispella wakkeri*, n. sp.

Some scale insects of sugar cane, L. ZEHNTNER (*Meded. Proefstat. Suikerriet W. Java Bul. 37, pp. 14, pl. 1*).—The author describes the following new species: *Chionaspis madiunensis, C. tegalensis*, an unnamed species of Chionaspis, and *Physcus flavidus.*

Notes on spraying and on the San José scale, H. P. GOULD (*New York Cornell Sta. Rpt. 1898, pp. 579–592, figs. 2*).—A reprint of Bulletin 144 of the station (E. S. R., 10, p. 468).

Carbolic soap and the green fly, J. H. WALKER (*Gard. Chron., 3. ser., 24 (1898), No. 607, p. 125*).—The author states that carbolic soap is one of the most efficient means for the destruction of the common rose aphis, and if properly applied will not only prove efficient for this, but for other species of aphis. The directions for preparation given are to dissolve 1 lb. of carbolic soap in 2 gal. of boiling water, to be kept tightly corked until required. Add 1 pt. of this to 4 pt. of soft water, and it may be applied morning and evening to infested plants.

Report of the entomologist, C. H. FERNALD (*Massachusetts Hatch Sta. Rpt. 1897, pp. 102–105*).—In this brief review of the year the author notes the appearance in several places in the State of the San José scale, the presence in small numbers only of the army worm, and its more or less extensive parasitism by a fly, the abundance of plant lice during the year, the occurrence of the tobacco cutworm (*Carneades messoria*) in the Connecticut Valley, and of the cankerworm. Relative to the latter different remedial measures are briefly discussed. The more effectual and cheaper method (compared with painting tree trunks with Morrill's tree ink) is thought to be spraying with Paris green in the usual proportions of 1 lb. to 150 gal. water.

Orchard pests, U. P. HEDRICK (*Utah Sta. Bul. 55, pp. 157–168, pls. 6, figs. 2*).—The author gives brief descriptions and suggests methods of treatment for the following insect and fungus pests: Codling moth, clover mite or red spider (*Bryobia pratensis*), pear slug, wooly aphis, peach-tree borer, aphides or plant lice, pear-leaf blister, San José scale, leaf-blight or shot-hole fungus, black knot, crown gall, mildew of the grape, and gooseberry mildew.

Formulas are given for the preparation of fungicides and insecticides and directions given for their application.

Some spraying mixtures, G. W. CAVANAUGH (*New York Cornell Sta. Rpt. 1898, pp. 719–721*).—A reprint of Bulletin 149 of the station (E. S. R., 10, p. 568).

Important insecticides: Directions for their preparation and use, C. L. MARLATT (*U. S. Dept. Agr., Farmers' Bul. 19, p. 31, figs. 3*).—This is the fourth revised edition of this bulletin (E. S. R., 6, p. 315).

A successful lantern trap, C. P. GILLETTE (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 69, 70, fig. 1*).—A lantern trap for insects is described and figured, and directions for using it are given.

Lepidoptera at light and sugar, C. P. GILLETTE (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 64–68*).—Records of moths taken at light and at sugar have been kept each year since 1890. Some of the data are presented in tabular form.

"A little computation upon the figures in the table will show that only 44 + per cent of all the moths taken were males and 55 + per cent were females. Of these females, 87 per cent still possessed eggs in their ovaries. Or, to put it differently, 49 per cent of all moths taken were gravid females. . . . So far as my studies have gone, I have no reason to think there is any family of moths, or any considerable number of species that fly to light in which a good proportion of gravid females are not found. I have come upon a few species, however, that have given very few gravid females at either light or sugar and most notable among these are 3 species of Chorizagrotis, viz, Auxilaris, Introferens, and Agrestis. . . . It is almost always the case that the males of a species are taken for a few nights before the females appear and continue longer, but if frequent captures are made during the continuance of the brood, the two sexes are usually taken in about even numbers. . . . It is fair to conclude that whenever moths are coming freely to lights or sugar, especially the former, a good proportion are females that have not deposited their eggs, and among those that so come, are several of our most destructive night-flying species."

The new law providing for the suppression and control of insect pests and plant diseases in Maryland, W. G. JOHNSON (*Maryland Sta. Bul. 55, pp. 145–149*).—This article gives the text of a recent law for the suppression and control of insect pests and plant diseases in Maryland and discusses it briefly.

Cordyceps militaris on a beetle, W. F. JOHNSON (*Irish Nat., 8 (1899), No. 1, p. 24*).—Notes the occurence of this fungus on *Necrophorus ruspator.*

FOODS—ANIMAL PRODUCTION.

The nutritive value of beef when cooked in the usual ways, K. FÖRSTER (*Der Nährwerth des Rindfleisches bei den gebräuchlichen Zubereitungsarten. Inaug. Diss., Berlin, 1897; abs. in Chem. Centbl., 1898, I, No. 21, pp. 1145, 1146; and Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 2, p. 782*).—The investigations were summarized as follows: Lean beef contains on an average 75.15 per cent water, 13.11 per cent protein, 7.65 per cent fat, and 4.31 per cent ash. When prepared for the table by the usual methods there was no loss of protein. Meat from the hind quarter contains 4.85 to 12.3 per cent fat, that from the shoulder 3.57 to 16.55 per cent. In the digestion experiments reported it was shown that white wine exercised a favorable influence on the digestibility of meat. The feces from a meat diet contained on an average 6.82 per cent protein, 10.39 per cent fat, and 14.33 per cent ash. When an abundant meat diet was consumed indican appeared in the urine as well as an increased amount of uric acid and nitrogen. When small amounts of meat were consumed at frequent intervals it was better digested than when larger amounts were consumed at less frequent intervals. In general beef was well digested. The coefficients of digestibility were: Dry matter, 93.08; nitrogen, 97.26; fat, 85.5; and ash 83.1 per cent. The meat from the shoulder was from 1 to 2 per cent more thoroughly digested than that from the hind quarter. The effect which preparation had on the beef is shown by the following list, the materials being arranged in the order of digestibility: Smoked beef, roast beef, beef boiled in water (boiling at the start), raw beef, corned beef, broiled beef, and beef boiled in water cold at the start.

The influence of sugar on the power of muscles to produce work, SCHUMBURG (*Ztschr. Ver. Rübenz. Ind., 1898, pt. 2, No. 505, pp. 110–129, pl. 1, figs. 10*).—A number of experiments with man briefly noted in a previous publication (E. S. R., 9, p. 175) are reported in detail. In some periods of the experiments the subject was given a solution of 30 gm. of sugar in 200 cc. of water; in other periods a solution of 0.25 gm. of dulcin in the same quantity of water. The two solutions had the same degree of sweetness. The amount of muscular work performed by the subject under the influence of these solutions and under normal conditions was compared. The work, which consisted in lifting a weight with the finger, was measured by a Mosso ergograph. The subject did not know the purpose of the experiments or the difference in the character of the two solutions.

The conclusion was reached that sugar even in such small amounts as 30 gm. enables the muscles to perform an extraordinary amount of work.

The author calls attention to the fact that practical tests of the value of sugar as a source of muscular energy are necessary.

Studies of dietaries, W. O. ATWATER and A. P. BRYANT (*Connecticut Storrs Sta. Rpt. 1897, pp. 130–153*).—In continuation of the work of previous years (E. S. R., 8, p. 419; 9, pp. 779, 780) a number of dietary studies are reported. The results are briefly summarized in the following table:

Results of dietary studies—food eaten per person daily.

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Man in Adirondack Mountains in winter		186	150	386	3,750
Man in Adirondack Mountains in spring		130	119	284	2,805
Farmer's family in New York		90	204	489	4,270
Man in Adirondack Mountains in summer	17.3	85	107	229	2,280
Two women in the Adirondacks in summer	20.8	101	139	291	2,900
Private boarding house in Middletown, Conn		95	130	358	3,065

Experiments on the digestion of food by man, W. O. ATWATER and F. G. BENEDICT (*Connecticut Storrs Sta. Rpt. 1897, pp. 154–167*).—A number of experiments on the digestibility of mixed diet are reported. In some cases the subjects were at rest, in others work was performed. In several tests alcohol formed a part of the day's ration. These digestion experiments were made in connection with metabolism experiments with subjects in the respiration calorimeter, Nos. 39, 40, 45, and 46 being in connection with those reported on p. 664. Each of the two periods covered 4 days, the subject being in the respiration chamber during the second period but not during the first. Full analyses were made of the food and feces. The fuel value was determined with a bomb calorimeter. In calculating the energy available suitable allowance was made for the fuel value of urea. In the following table is shown the coeffi-

cients of digestibility and the energy available in the different experiments.

Result of digestion experiments with man.

Number of experiment.	Metabolism experiment number.	Description.	Protein.	Fat.	Carbohydrates.	Available energy.
		FIRST PERIOD.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
37	5	Mixed diet, ordinary work	92.7	94.0	98.0	89.9
39	6	Mixed diet, hard work	90.1	95.3	97.6	91.2
41	7	Mixed diet, with alcohol, rest	90.9	93.6	98.3	89.8
43	8	Mixed diet, light work	91.4	94.5	97.4	89.7
45	9	.....do	90.9	92.1	95.8	88.4
47	10	Mixed diet, with alcohol, rest	94.9	92.1	98.6	91.3
49	11	Mixed diet, hard work	90.6	93.2	97.8	91.2
51	12	Mixed diet, with alcohol, hard work	95.3	94.3	96.4	91.2
		Average of 8 periods	92.1	93.6	97.5	90.3
		SECOND PERIOD.				
38	5	Mixed diet, rest	91.4	93.9	97.6	90.0
40	6	Mixed diet, hard work	92.2	96.9	98.3	92.6
42	7	Mixed diet, with alcohol, rest	94.7	96.3	98.8	91.8
44	8	Mixed diet, rest	94.0	95.6	98.2	90.7
46	9	.....do	93.4	93.9	96.5	89.5
48	10	Mixed diet, with alcohol, rest	92.9	88.1	97.8	90.2
50	11	Mixed diet, hard work	88.8	93.0	97.5	90.9
52	12	Mixed diet, with alcohol, hard work	93.6	95.9	98.7	93.1
		Average of 8 periods	92.6	94.2	97.9	91.1

A respiration calorimeter and experiments on the conservation of energy in the human body, W. O. ATWATER and E. B. ROSA (*Connecticut Storrs Sta. Rpt. 1897, pp. 212–242, figs. 3*).—The portion of this apparatus which is concerned in the determination of income and outgo of material has already been described (E. S. R., 9, p. 863). In the present publication the portion which has to do with the measurement of income and outgo of energy is described, as well as check experiments in which heat was liberated in the respiration chamber by burning alcohol and by means of an electric current and 2 experiments with man. The metal walls of the respiration chamber are kept at the same temperature, therefore no heat can pass in or out of the chamber through the walls. The ventilating current is kept at the same temperature as it enters and leaves the chamber. Heat generated in the chamber is absorbed by a current of water, which passes through "absorbers" within the chamber. The various devices for measuring the current of air, controlling its temperature, for sampling the air, measuring the heat of the incoming and outgoing currents of water, and other devices are described in detail.

"In order that the ventilating current of air shall not carry out of the chamber any more or any less heat than it brings in, the temperature must be the same when it enters as when it leaves. Accordingly the incoming air, which leaves the brine tank [where it is largely freed from moisture by cooling] at a very low temperature, is warmed before its entrance to the chamber to the temperature of the outgoing

air. The devices for this purpose are such that the difference of temperature of the incoming and outgoing currents can be kept inside of 0.01° C. In actual experiments the positive and negative differences are made to counterbalance each other."

The arrangements for preventing the passage of heat through the walls of the calorimeter are described as follows:

"The difference between the temperature of the copper wall and that of the zinc is measured by a system of thermo-electric junctions, in 304 pairs, distributed over the sides, top and bottom, one-half of the junctions (iron-German silver) being in close thermal contact with the copper wall and the other half (German silver-iron) with the zinc wall. The difference of temperature of the two walls is made as small as possible by warming or cooling the air in the space B, and the positive and negative differences are made to counterbalance each other. Thus the corresponding movements of small quantities of heat inward and outward also counterbalance, and the chamber neither gains nor loses heat through the walls.

"For the measurement of differences of temperature, as well as for the warming and cooling, the walls of the calorimeter are considered as divided into four sections, viz, (1) the top; (2) the upper half of the sides or 'upper zone;' (3) the lower half of the sides or 'lower zone;' (4) the bottom. The systems of thermo-electric elements for heat measurements, of wires for warming and of water pipes for cooling, are each divided into corresponding sections."

The heat carried out by the water current is measured as follows:

"The principle employed is simple. The chamber neither gains nor loses heat by the air current nor through the walls. The current of cold water which passes through the heat absorbers inside the chamber is caused to enter at a temperature generally but little above the freezing point, and to flow out at such a rate as to absorb and carry off the heat just as fast as it is generated inside the apparatus. The temperature of the water is measured as it enters and as it comes out. An electrical thermometer indicates the difference of temperature between the incoming and outgoing water currents by the difference of resistance of two coils of thin copper wire, of which one is in each pipe at the place of entrance or exit from the calorimeter. The difference is measured by a Wheatstone bridge on the observer's table. The mass of water is measured automatically by apparatus at the right of the window of the respiration chamber.

"From the mass of the water which has passed through the absorber in a given time and the rise in temperature the quantities of heat brought out are readily calculated. To this is to be added a certain amount of heat which is carried away with the water vapor produced in the apparatus. This is practically the difference between the water vapor in the incoming and outgoing air. From the amount of this vapor, and its latent heat at the temperature of exit, the amount of heat it carries out is easily computed."

The apparatus for measuring and sampling the ventilating current is described as follows:

"Three forms of apparatus have been used for maintaining the air current and measuring its volume. One consisted of an ordinary air pump with a meter made by Elster in Berlin. With this we have been unable to make measurements as accurate as seem to us desirable.

"For taking samples of air for analysis aspirators of 150 liters capacity were employed at the outset and are still used. The measurements with these have been found quite accurate. The most satisfactory arrangement we have found, and one which serves the threefold purpose of maintaining the air current, measuring its

volume, and delivering aliquot samples of convenient size for analysis, is an apparatus designed and made by Mr. O. S. Blakeslee, and appropriately designated by him as a 'meter pump.' The essential parts for maintaining the air current and measuring its volume are cylinders of steel. There are two pumps which work in unison. Three steel cylinders are employed for each pump. The inner and outer cylinders are arranged concentrically, with an annular space 1.2 cm. in width between them. This space is partly filled with mercury. Between the inner and outer cylinders, which are stationary, plays a central cylinder, its lower portion being immersed in the mercury. The central cylinder is closed at the top and is raised and lowered by a walking beam The inner cylinder is also covered at the top, but through this cover are two circular apertures opened and closed alternately by an automatic valve, actuated by a compressed-air mechanism underneath. Connected with these apertures are pipes passing downward through the inner cylinder. One serves to convey the air, as it comes from the chamber, into the pump as the central cylinder rises. As the cylinder falls the other pipe conveys the air outward, and thus plays the part of a discharge pipe. The automatic valves open and close the inlets and discharge pipes so that with each stroke of the inner cylinder the air is cut off at the proper time. The length of the stroke of the cylinder is determined exactly by rods provided with stops, these rods playing through guides on two sides of each cylinder, and by this arrangement the only variation is that which comes with the very slight changes in the length of the rods due to changes of temperature. The air coming from the discharge pipe escapes into the room, but by a special device the air of each fiftieth stroke of each pump is diverted into a receptacle, from which it is being constantly drawn for analysis."

In the electrical check experiment a total of 3,017.4 calories of heat was liberated in the chamber. The amount measured was 3,016.7 calories. In other words, the two values were practically identical.

"In the alcohol tests the average amounts found by actual experiment were, for carbon, 99.6 per cent, hydrogen, 100.6 per cent, and heat, 99.8 per cent of the theoretical amounts. It thus appears that this apparatus, when used for the analysis of alcohol and the determination of its heat of combustion, gives results nearly, if not quite, as accurate as are obtained by the ordinary laboratory methods."

Of the two experiments with man, one was made in May, 1897, and the other in January, 1898. The former is reported in much more detail than the other.

"The experiments with a man each continued during 8 days, during the last 4 days and 5 nights of which the subject was in the respiration chamber. The diet during each experiment was uniform through the whole 8 days. The purpose of the preliminary period of 4 days was to bring the body into at least approximate nitrogen and carbon equilibrium with the food and to make the determination of the amounts of nutrients absorbed as nearly accurate as practicable. The income and outgo of nitrogen were determined during this period, which thus amounted to a digestion and metabolism experiment. The metabolism of nitrogen, carbon, hydrogen, and energy was determined during the final period of 4 days.

"In one of the 2 experiments the man had as little muscular exercise as he could well have with comfort. In the other he was engaged in quite active muscular exercise. The external muscular work was expended in driving a dynamo which produced an electric current. The latter was passed through a resistance coil, and the energy was transformed into heat, which was measured with that given off from the body."

The daily income and outgo of nitrogen and carbon and the calculated loss of protein and fat is shown in the following table.

Average daily income and outgo of nitrogen and carbon, with the estimated gain or loss of protein and of fat.

Number of experiment.	Subject and occupation.	Nitrogen. In food.	Nitrogen. In feces.	Nitrogen. In urine.	Nitrogen. Gain (+) or loss (—).	Carbon. In food.	Carbon. In feces.	Carbon. In urine.	Carbon. In respiratory products.	Carbon. Gain (+) or loss (—).	Calculated gain or loss. Of protein.	Calculated gain or loss. Of fat.
		Gms.	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*
6	E. O. at work ..	19.1	1.5	16.5	+1.1	334.0	12.4	12.5	345.2	—36.1	+6.9	—51.9
9	E. O. at rest....	19.1	1.3	18.4	— .6	254.7	12.9	12.6	223.6	+ 5.6	—3.6	+ 9.8

In the following table is shown the daily income and outgo of protein and energy in the same experiments:

Comparison of daily income and outgo of protein and energy.

Number of experiment.	Subject and occupation.	Protein. Of food.	Protein. Actually oxidized.	Energy. Of food.	Energy. Of material actually oxidized.	Energy. Measured by respiration calorimeter.	Energy. Difference between theoretical and measured.
		Gms.	*Gms.*	*Calories.*	*Calories.*	*Calories.*	*Per cent.*
6	E. O. at work................	119.4	103.1	3,678	3,864	3,739	3.2
9	E. O. at rest	119.4	115.0	2,717	2,354	2,329	1.1

These experiments and their bearing upon the problem of the conservation of energy in the animal body are discussed in some detail.

"The differences between the income and outgo of energy as measured in these two cases were 3.2 and 1.1 per cent, and averaged 2.2 per cent. The amount of energy as measured was in each case less than the theoretical amount of potential energy in the material consumed. The larger discrepancy was in the first experiment. Certain sources of error in this appear to have been eliminated, at least in part, in later experiments, of which the second was one. In these latter the agreement is very close, the energy found being about 39 per cent of the theoretical. On the whole the agreement between theoretical amounts of energy transformed and those found in the experiments is as close as could be expected under the circumstances.

"It would be wrong to assume that these experiments demonstrate completely the conservation of energy in the animal organism. They do, however, approach very closely to such demonstration for the case of the man under experiment."

Digestion experiments,[1] F. E. EMERY and B. W. KILGORE (*North Carolina Sta. Bul. 118, pp. 275–299*).—In previous work of the station (E. S. R., 3, p. 452; 4, p. 736; 5, p. 1081; 7, p. 702) it was found that when cotton-seed meal was fed with coarse fodders there was an increase in the total amount of carbohydrates digested more than sufficient to make up for the loss observed in the percentage of protein digested. A number of experiments were therefore made with 4 sheep to determine the digestibility of timothy and crab-grass hay fed alone and with

[1] A bulletin bearing the same number and date, in which the detailed tables of the digestion experiments were omitted, was also issued by the station.

different amounts of cotton-seed meal. The sheep were kept in suitable stalls and were fed corn silage morning and noon and with mixed hay at night for a few days before the tests proper began. The experiments were conducted by the usual methods. The weights of the sheep were recorded in every case. When cotton-seed meal was fed with the timothy hay or crab-grass hay, the digestibility of the hay alone was computed by taking into account the coefficients of digestibility of the cotton-seed meal as determined in previous experiments. The coefficients of digestibility of the different rations is shown in the following table:

Results of digestion experiments with sheep.

	In dry matter.						
	Dry matter.	Protein.	Albuminoids (albuminoid nitrogen × 6.25).	Ether extract.	Nitrogen-free extract.	Crude fiber.	Ash.
Timothy hay:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent*
Sheep No. 1	54.12	34.43	26.49	22.40	60.34	52.30	22.56
Sheep No. 2	48.35	32.53	10.16	12.72	55.82	43.60	23.46
Average	51.2	33.5	18.3	17.6	58	48	23
Timothy hay and cotton-seed meal, 16:1:							
Sheep No. 1	57.04	52.51	50.51	49.05	62.95	51.97	28.54
Sheep No. 2	53.59	48.88	44.48	51.09	61.31	45.85	17.08
Average	55.3	50.7	47.5	50.1	62.1	48.9	22.8
Calculated digestibility of hay alone	54.1	28.4	....	36.2	62.2	48.9	22.4
Timothy hay and cotton-seed meal, 12:1:							
Sheep No. 1	56.70	58.19	58.78	64.78	62.01	51.02	30.66
Sheep No. 2	50.54	51.65	52.52	63.39	57.81	43.33	11.78
Average	53.6	55.9	55.7	64.1	59.9	47.2	21.2
Calculated digestibility of hay alone	52.0	32.4	....	53.4	59.8	47.2	19.9
Timothy hay and cotton-seed meal, 8:1:							
Sheep No. 1	50.67	56.10	58.83	62.29	56.68	43.73	13.40
Sheep No. 2	47.13	53.77	57.91	60.66	53.29	39.74	7.35
Average	48.9	54.9	58.4	61.5	55.0	41.7	10.4
Calculated digestibility of hay alone	45.8	20.8	....	43.6	54.5	41.6	6.2
Timothy hay and cotton-seed meal, 4:1:							
Sheep No. 1	51.58	59.80	63.47	79.19	57.67	43.04	....
Sheep No. 2	51.37	61.37	62.76	70.26	56.93	42.42	56.64
Average	51.5	60.59	63.12	74.73	57.30	42.73	*a* 5.7
Calculated digestibility of hay alone	45.8	3.9	....	55.4	56.7	42.6	....
Timothy hay and cotton-seed meal, 2:1:							
Sheep No. 1	61.93	72.80	74.85	85.26	69.17	44.21	21.09
Sheep No. 2	56.27	70.04	72.95	84.48	64.67	34.68	8.26
Average	59.1	71.42	73.90	84.87	66.92	39.45	14.68
Calculated digestibility of hay alone	52.0	6.3	....	71.7	68.4	38.9	6.6
Timothy hay and cotton-seed meal, 1:1:							
Sheep No. 1	62.75	75.98	79.31	89.35	71.91	26.89	28.22
Sheep No. 2	60.06	75.23	78.98	87.82	65.67	28.79	26.61
Average	61.4	75.6	79.2	89.0	68.8	27.8	27.4
Calculated digestibility of hay alone	49.24	....	....	83.0	73.0	24.8	20.8
Timothy hay (second test):							
Sheep No. 1	58.03	39.17	42.08	53.09	69.05	46.83	33.05
Sheep No. 2	50.34	30.93	29.87	45.27	63.08	37.60	24.43
Average	54.2	35.1	36.0	49.2	66.1	42.2	28.7
Crab-grass hay:							
Sheep No. 1	53.45	....	....	42.21	51.83	63.74	42.62
Sheep No. 2	51.43	.5	....	45.33	52.13	59.37	38.57
Sheep No. 3	47.46	6.89	....	49.78	49.63	50.19	46.73
Sheep No. 4	50.26	....	....	32.98	50.35	60.10	49.74
Average	50.7	....	....	42.6	51.0	58.4	44.4

a Only for sheep No. 2.

An experiment was also attempted with timothy hay and undecorticated sunflower-seed meal, but the sheep would not eat the meal. The authors believe that the meal may have been too old.

Investigations on the amount of food and energy required for fattening full-grown steers, O. KELLNER, A. KÖHLER, ET AL. (*Landw. Vers. Stat., 50 (1898), No. 3-4, pp. 245-296*).—In continuation of previous work (E. S. R., 9, 167), the authors report experiments with 3 steers to determine the amount of food and energy required for fattening. The methods followed are similar to those previously reported, and the same respiration apparatus was used. In the first test steer 1, weighing about 750 kg., was fed a ration consisting entirely of meadow hay, 9 kg. In the second test steer 2, weighing about 750 kg., was fed a ration of 6 kg. meadow hay and 3 kg. of rye bran. In the third experiment steer 3, weighing about 860 kg., was fed a ration of 6 kg. meadow hay, 5 kg. of beet chips, and 1 kg. of rye bran. The coefficients of digestibility in the 3 experiments are as follows:

Coefficients of digestibility.

	Dry matter.	Organic matter.	Crude protein.	Protein.	Non-albuminoid nitrogen.	Fat.	Nitrogen-free extract.	Crude fiber.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Experiment 1, steer 1: Meadow hay	57	59	50	57.3	100	43.8	61.8	53.2
Experiment 2, steer 2: Meadow hay, rye bran	84.5	86.5	83.9	94.8	100	83.7	89.5	59.0
Experiment 3, steer 3: Meadow hay, beet chips, and rye bran	68.4	70.6	59.2	67.5	100	31.6	76.2	65.4

The income and outgo of nitrogen and carbon was as follows:

Income and outgo of nitrogen and carbon.

	Nitrogen.				Carbon.				
	In food.	In urine.	In feces.	Gain (+) or loss(—).	In food.	In urine.	In feces.	In respiratory products.	Gain (+) or loss(—).
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Experiment 1, steer 1, 7.303 kg. hay, 27.65 kg. water	109.40	65.57	57.66	—13.83	3,403.7	183.5	1,506.1	1,057.3	—343.2
Experiment 2, steer 2, 5.197 kg. hay, 2.621 kg. rye bran, 23.96 kg. water	164.24	111.44	55.61	— 2.81	3,651.6	187.8	1,256.9	2,233.9	— 27.0
Experiment 3, steer 3, 5.179 kg. hay, 4.328 kg. beet chips, 0.866 kg. rye bran, 34.84 kg. water	179.82	96.10	78.67	+ 5.05	4,695.2	184	1,511.5	2,892.8	+106.9

From the balance of nitrogen and carbon, it was calculated that steer 1 lost 84.5 gm. of water-free flesh, 391.2 gm. fat; steer 2 lost 17.2 gm. water-free flesh and 23.7 gm. fat; or, in other words, there was practically a nitrogen equilibrium. Steer 3 gained 30.9 gm. water-free flesh and 118.8 gm. fat. The authors calculated that an adult steer, when in good condition for fattening, requires per day, per 1,000 kg. live weight,

0.85 kg. digestible crude protein (equal to 0.78 true protein) and 6.64 kg. nitrogen-free material. Of these quantities a small amount of protein (13 gm.) and of nitrogen-free material (equal to 106 gm. fat) was required for the building and repair of hair, of hoof, skin, etc.

Following methods outlined in the earlier investigations, the income and outgo of energy in the 3 experiments was calculated.

Income and outgo of energy.

	Income.	Outgo.
Experiment 1:	*Calories.*	*Calories.*
Meadow hay (7,303 gm.)	32, 252. 2	
Feces (4,668.2 gm.)		14, 653. 5
Nitrogen evolved in drying feces		15. 5
Urine		1, 789. 9
Methan (156.8 gm.)		2, 077. 0
Protein tissue lost (84.5 gm.)	374. 5	
Fat tissue lost (391.2 gm.)	3, 716. 4	
Total outgo		18, 535. 9
Balance	17, 807. 2	
Experiment 2:		
Meadow hay (5,197 gm.)	22, 951. 5	
Rye bran (2,621 gm.)	12, 158. 3	
Feces (2,641 gm.)		12, 331. 1
Nitrogen evolved in drying feces		14. 7
Urine		1, 918. 6
Methan (165.4 gm)		2, 190. 9
Protein tissue lost from body (17.2 gm.)	76. 2	
Fat tissue lost (23.7 gm.)	225. 1	
Total outgo		16, 455. 3
Balance	18, 654. 5	
Experiment 3:		
Meadow hay (5,179 gm.)	22, 787. 6	
Beet chips (43.28 gm.)	17, 855. 2	
Rye bran (866 gm.)	4, 033. 5	
Feces (3,278 gm.)		14, 733. 6
Nitrogen evolved in drying feces		27. 4
Urine		1, 820. 9
Methan (267.09 gm.)		3, 536. 7
Protein tissue gained (30.9 gm.)		317. 5
Fat tissue gained (118.8 gm.)		2, 052. 0
Total outgo		20, 118. 6
Balance	24, 557. 7	

As shown by the 3 experiments the average energy required of a steer per 1,000 kg. live weight is 24,979 calories, when the temperature of the surrounding air is 15.7° C. The deduction is drawn from the experiments that feeding is less profitable the longer the feeding period is prolonged. The authors discuss the energy of the feces, urine, and methane excreted, and deducting these factors from the energy of the food, calculate its physiological nutritive effect. The physiological nutritive effect per gram of meadow hay in the first experiment was calculated to be 3.435 calories; of 1 gm. of meadow hay and rye bran in experiment 2, 3.722, and of 1 gm. of meadow hay, beet chips, and rye bran in experiment 3, 3.593 calories. The physiological nutritive effect of 1 gm. of digestible rye bran is calculated to be 4.102 calories. The experimental data are reported in full in tabular form.

Fattening cattle in North Dakota, J. H. SHEPPERD (*North Dakota Sta. Bul. 33, pp. 281-292*).—The author discusses at some length cattle feeding under existing conditions in North Dakota. Investigations made in different parts of the country bearing upon the subject are quoted. In his opinion cattle can be profitably fattened on corn fodder, hay, and barley on nearly all the farms of North Dakota. A test of the comparative value of bran and bran and shorts for fattening steers is reported. The test was made with 2 lots of 5 grade steers each. These animals were believed to be on an average better than the range stock of the State. The experiment proper was preceded by a preliminary period of 1 month. All the steers were fed bran and shorts 1:1 and 1 lb. of linseed meal per head daily. The steers in lot 1 ate an average of 12 lbs. of grain per head daily and gained a little less than $1\frac{1}{2}$ lbs. per head. Lot 2 ate practically the same amount of grain and gained a little more than $1\frac{1}{3}$ lbs. per head daily. The test proper began immediately after the close of the preliminary period and continued 12 weeks. Lot 1 was fed barley and lot 2 bran and shorts 1:2. Each lot was fed oil meal in the proportion of 1 lb. to 10 lbs. of grain. Lot 1 ate on an average 16 lbs. of grain daily and lot 2, $14\frac{1}{3}$ lbs. The steers were confined in stalls and were fed separately and given all the hay they would eat in addition to the grain. The financial statement is based on barley at 75 cts., linseed meal at $1, bran and shorts at 60 cts. per 100 lbs., and hay at $4 per ton.

The results of the test are shown in the following table:

Result from feeding steers barley and bran and shorts.

Kind of feed.	Average weight of steers at beginning of test.	Grain eaten per day.	Hay eaten per day.	Gain in weight per day.	Grain eaten per lb. gain.	Profit per steer.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Lot 1, fed barley	1,080.4	15.9	16.9	1.74	9.14	$4.51
Lot 2, fed bran and shorts	1,054.8	14.32	17.16	1.35	10.6	5.03

The principal conclusions follow:

"Range steers require a long preliminary feeding before a heavy supply of grain is given them.

"Eleven hundred and fifty pound steers fed for a period of 6 months will eat an average of about $16\frac{3}{4}$ lbs. of grain and 12 lbs. of hay per day.

"Range steers fed in a commercial way will gain from $1\frac{1}{4}$ lbs. to $1\frac{1}{2}$ lbs. per day.

"Cattle should neither be gorged nor starved for feed or water before shipment is made. A medium quantity of dry feed is best.

"Barley gives a heavier gain per 100 lbs. of grain fed and a higher rate of gain per day than does bran and shorts.

"With the prices for feed which prevailed locally, bran and shorts gave the cheaper gain and the greater profit."

Fattening steers in winter, T. SHAW (*Minnesota Sta. Bul. 58, pp. 469-509, figs. 2*).—These tests were made in continuation of work previously reported (E. S. R., 8, p. 241).

Fattening Minnesota steers (pp. 469–485).—In order to study the relative value of light, moderate, and heavy feeding and the relative merits of steers of different grade a test was made with 3 lots, each containing a Shorthorn, a Hereford, and an Aberdeen Poll steer. They were about 2 years old and were from cows of a common mixed breed and a pure-bred sire. They were all purchased in Minnesota. The net cost of the Aberdeen Poll steers was $3.35 per 100 lbs.; the Shorthorns $3.67, and of the Herefords $3.70. The test began January 6, 1896, and covered 150 days. At the beginning of the test lot 1 was fed per head daily 5 lbs. of meal composed of equal parts of bran, oats, barley, and corn; lot 2, 7 lbs., and lot 3, 9 lbs. of the same mixture. This was increased 1 lb. per head every 4 weeks. February 10 the animals were given a pound of linseed cake per head daily in addition. On March 16 the amount was doubled and the grain ration was changed to bran, barley, and corn 1:1:2. The maximum amounts of meal fed were 10, 12, and 14 lbs. in the 3 lots, respectively. The steers were fed daily 25 lbs. of corn silage per head in addition to the grain and all the native hay they would eat up clean. They were fed in stalls and were given water twice a day, with salt 2 or 3 times a week. The Herefords were dehorned at the beginning of the test. This interfered with their feeding for about 14 days. The financial statement is based on bran at $6.50, oil cake $14 per ton, native hay at $3, and corn silage at $1 per ton, and oats at 14 cts., barley 16 cts., and corn 18 cts. per bushel. At the close of the test the steers were sold in St. Paul for $4.10 per 100 lbs., a shrinkage of 4 per cent being allowed.

The results of the test are shown in the following table:

Summary of results of steer feeding.

	Average amount of food consumed per steer per diem.			Total weight at beginning.	Total increase per lot.	Average cost of 100 lbs. increase.	Net profit per lot.
	Hay.	Silage.	Meal.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		
Lot 1	6.91	23.04	8.58	3,110	741	$3.55	$10.21
Lot 2	6.53	21.77	10.48	3,165	776	3.72	9.20
Lot 3	5.71	18.07	11.94	3,140	692	4.37	4.70

Fattening range steers (pp. 486–504).—A test similar to the preceding was made with 9 range steers, divided into 3 lots of 3 each. They were purchased in Montana and were worth at the beginning of the test $3.13 per 100 lbs. In some of the steers Hereford and Polled Aberdeen blood predominated, in others Shorthorn blood. They were a fair type of beef steers. They had been suckled by their dams in winter and when necessary given some hay. Otherwise they fed on the range. The test began December 7, 1896, and closed April 17, 1897. All the lots were fed bran, barley, corn, and linseed cake 3:3:3:1, with hay and silage in addition, lot 1 being fed 7 lbs. of grain per head daily, lot 2 9 lbs., and lot 3 11 lbs. at the beginning of the test. These amounts

were increased 1 lb. per month, until lot 1 was fed 11, lot 2 13, and lot 3 15 lbs. In some instances it was found necessary to diminish the amounts. It was the intention to feed 25 lbs. of corn silage per day, but the amount was finally reduced to 18 lbs. One steer in lot 2 was given no silage. The financial statement is based on barley at 16 cts. and corn 18 cts. per bushel; bran at $6.50, oil cake at $14, hay at $3.50, and corn silage at $1.25 per ton. The results are given in the following table:

Summary of results of steer feeding.

	Average amount of food consumed per steer per diem.			Total weight at beginning.	Total gain per lot.	Total cost of food consumed per lot.	Average cost of 100 lbs. of gain.	Net profit per lot.
	Hay.	Silage.	Meal.					
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			
Lot 1	10.58	18.17	9.08	3,620	709	$25.71	$3.94	$53.20
Lot 2	8.99	20.31	11.17	3,413	785	28.35	3.69	51.21
Lot 3	9.06	17.44	13.09	3,465	758	30.70	4.21	48.34

The following are some of the deductions drawn:

"The wonderfully low cost of the food fed should not be overlooked. The average cost of feeding one steer per day in the 3 experiments was but 8.36 cts. . . .

"The low cost of the increase per 100 lbs. is also noteworthy. With the steers in all the lots it was $4.62, while the average price for which it was sold was $4.66 per 100 lbs. During the 3 years of feeding, therefore, the cost of the increase was less than it sold for. In but few countries of the world could this be accomplished with food charged at market values. . . .

"The net profit on each of the steers in lots 1 was $1.93 more than on each of the steers in lots 3. It was $1.41 per animal more than the average profit from each of the steers in lots 2 and 3 combined, and in each of the 3 experiments was the profit greatest on the steers fed the light meal ration. It is fair to infer, then, that had the steers in these lots been fed as the steers in lots 1, $25.38 additional would have been added to the net profit on the 18 steers in lots 2 and 3. And it should also be borne in mind that the dearer relatively the price of grain, the greater will the contrast be between feeding meal or grain in moderate or in large quantities. The increase in the quantities of meal fed did not result in a decrease in the consumption of fodder to the extent expected. . . .

"The average quantity of meal fed per day in securing the largest profit was only 8.23 lbs. To this must be added some corn which the silage contained. The average amount of silage consumed per day throughout the feeding was a little more than 21 lbs. and it contained a moderate amount of corn, but how much can not be stated. In any event, it would not increase the meal fed daily to those steers to very much beyond 10 lbs. The writer can not but conclude, therefore, that in Western-fed lots much grain is oftentimes fed to no purpose, since from 25 to 30 lbs. of shelled corn are frequently fed per day to one cattle beast and to one pig that feeds upon its droppings."

The feeding value of whole cotton seed, crushed cotton seed, and cotton-seed meal and hulls for finishing steers for market, R. L. BENNETT (*Arkansas Sta. Bul. 52, pp. 47–52*).—A test was made with 3 lots of 5 steers, to compare cotton seed and cotton-seed products. Lot 1 was fed cotton-seed meal and hulls in the same proportion as they exist in the seed; lot 2, whole cotton seed, and lot 3 ground cotton seed.

These materials were fed *ad libitum.* In addition each lot was fed cowpea hay. The test covered 90 days. The steers were fed in large box stalls opening into small lots.

The results of the test are shown in the following table:

Results of steer-feeding experiments.

	Total weight at beginning.	Total food consumed.					Average daily gain.
		Cotton-seed meal.	Cotton-seed hulls.	Whole cotton seed.	Ground cotton seed.	Cowpea hay.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1	3,800	2,189	2,900			6,252	2
Lot 2	3,806			4,609		6,591	1.9
Lot 3	3,826				4,630	6,535	1.9

The principal conclusions follow:

"This trial suggests the practice, when meal and hulls sell for more than seed, or when they sell for relatively the same price, of feeding seed during the first part of the feeding period, not exceeding 60 days, and of feeding meal and hulls during the last part of the period.

"The excess of oil in seed over that in meal would seem to be the cause of the diminished appetite of the steers fed seed when the weather was warm and sultry. The diminished appetites suggest that when seed is to be fed without any meal either corn or bran should partly or wholly replace the seed when the weather affects the appetites to any extent during the last part of the feeding.

"Feeding seed as the only concentrated food for fattening should be done only during the cool part of the year."

Corn meal and shorts as food for pigs, C. S. PLUMB and W. B. ANDERSON (*Indiana Sta. Bul. 71, pp. 55–60*).—A test of the comparative value of corn meal and shorts covering 70 days was made with 2 lots of 3 high-grade Chester White sows each. Lot 1 was fed shorts and corn meal and lot 2 corn meal. The pigs were kept in pens about 30 by 15 ft. with a small shelter. The financial statement is based on shorts at 70 cts. and corn meal at 65 cts. per 100 lbs. At the beginning the total weight of lot 1 was 387.5 and lot 2, 385.75 lbs. The average daily gain per head of lot 1 was 1.68 and of lot 2, 1.55 lbs. The pigs in lot 1 consumed on an average 3.41 lbs. corn meal and the same amount of shorts per day; lot 2 consumed 6.72 lbs. of shorts per day. The cost per pound of gain for lot 1 was 0.0274 cts. and of lot 2, 0.028 cts. The sows in the 2 lots were not pregnant nor suckling young and came into heat at regular intervals during the feeding period. The gains, which were recorded each week, varied. In the author's opinion, no variation in gain in weight could be definitely ascribed to the fact that the sows were in heat.

Feeding pumpkins to pigs, H. T. FRENCH (*Oregon Sta. Bul. 51, pp. 22–25*).—The feeding value of pumpkins was tested with 6 Berkshire pigs 8 months old at the beginning of the trial. They had been pastured on a stubble field for 6 weeks previous to the test. The test proper, which was preceded by a preliminary period of 7 days, began

October 30 and covered 56 days, and was divided into 4 periods of 14 days each. The pigs were fed twice a day pumpkins which had been steamed after cutting up and removing the seeds. When thoroughly cooked the pumpkins were mixed with some shorts and a little salt. The financial statement is based on pumpkins at $2.50 and shorts at $12 per ton.

During the entire period the pigs made a total gain of 499 lbs., consuming 7,523 lbs. of pumpkins and 924 lbs. of shorts. The average cost per pound of gain was 2.9 cents. "On the whole the results were quite satisfactory when compared with previous work in feeding grain rations alone. The pigs seemed to relish the food and were very contented." The meat produced was regarded as very satisfactory.

Feeding artichokes to pigs, H. T. FRENCH (*Oregon Sta. Bul. 54, pp. 26–28*).—Six Berkshire pigs which had been pastured on a stubble field were fed artichokes with a little grain (chopped wheat and oats 1:1) from October 22 until December 11. The artichokes were grown near the pens and were gathered by the pigs. It is estimated that the artichokes yielded 740 bu. to the acre. The pigs were weighed every 14 days. During the 8 weeks of the test they gained 244 lbs. and consumed 756 lbs. of grain and the artichokes from an eighth of an acre (92.5 bu.); that is, in addition to artichokes 3.1 lbs. of grain was required for a pound of gain. "In other experiments we have found that it takes about 5 lbs. of mixed grain to produce a pound of gain; hence, on this basis, the artichokes consumed would represent 2 lbs. of grain in producing each pound of gain in live weight."

The attempt was made to feed the artichokes without grain, but this was not successful.

Poultry experiments, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1897, pp. 37–44*).—In continuation of work previously reported (E. S. R., 9, p. 376) tests were made with poultry to learn the effect of condition powder and the value of cut bone *vs.* animal meal and of clover rowen *vs.* cabbage for egg production.

Effect of condition powder (pp. 37–41).—The test, which began January 1 and continued to May 2, was made with 1 lot of 19 and 1 lot of 20 Light Brahma hens. Lot 1 was fed a mixed grain ration, with cut clover and fresh cabbage from time to time. Lot 2 was fed the same ration with the addition of condition powder. The nutritive ratio of the first ration was 1 : 5.16 and of the second 1 : 5.14.

The results are briefly summarized as follows:

Results of feeding poultry with and without condition powder.

	Food consumed.	Cost of food per day per fowl.	Number of eggs produced.	Weight per egg.	Cost of food per egg.
	Pounds.	*Cent.*		*Ounces.*	*Cents.*
Lot 1	532.0	0.285	532	1.958	1.24
Lot 2 (condition powder)	549.3	.280	540	1.993	1.25

Samples of the eggs were analyzed. Those from the fowls given condition powder were somewhat richer in dry matter, protein, and fat. The eggs were also tested by housekeepers, but definite conclusions were not drawn. The fowls which had received condition powder were reported as dressing rather better than the other lot. In the author's opinion the differences observed in the 2 lots were too small to be considered decisive, but the conclusion seems warranted that the condition powder did not pay for its use.

Cut bone vs. animal meal (pp. 41, 42).—A test, beginning January 1 and continuing until May 2, was made with 2 lots of 20 Plymouth Rock hens. Each lot was fed a mixed ration with clover and cabbage. In addition lot 1 was fed Chicago gluten and cut bone and lot 2 Buffalo gluten and animal meal. The nutritive ratio of the ration of lot 1 was 1: 5.05 and of lot 2, 1: 4.45. The average results are shown in the following table:

Comparison of cut bone and animal meal for poultry.

	Food consumed	Cost of food per day per fowl.	Number of eggs produced.	Weight per egg.	Cost of food per egg.
	Pounds.	*Cent.*		*Ounces.*	*Cents.*
Lot 1 (cut bone)	525.5	0.28	508	2.0034	1.3
Lot 2 (animal meal)	513.1	.25	639	2.0270	.97

As shown by analysis, the eggs from the hens fed cut bone contained rather more protein but less fat than the others. Tests of the cooking qualities of the eggs were not decisive. The author notes that in this trial the animal meal gave better returns than the cut bone as regards egg production, the results being the opposite of those obtained in the experiments of the preceding year.

Clover rowen vs. cabbage (pp. 42–44).—A test of the same duration as the last was made with 2 lots of 19 Plymouth Rock pullets. Both lots were fed wheat, oats, bran, middlings, animal meal, cut bone, and oatmeal. In addition lot 1 was fed clover and lot 2 cabbage. The nutritive ratios of the 2 rations were for lot 1, 1: 4.99 and for lot 2, 1: 4.838. The results are summarized in the following table:

Comparison of clover rowen and cabbage for poultry.

	Food consumed	Cost of food per day per fowl.	Number of eggs produced.	Weight per egg.	Cost of food per egg.
	Pounds.	*Cent.*		*Ounces.*	*Cents.*
Lot 1 (clover rowen)	519.5	0.29	466	2.0472	1.5
Lot 2 (cabbage)	559.5	.28	588	1.9880	1.18

Analysis showed that the eggs from the lot fed cabbage contained a higher percentage of dry matter, protein, and fat. As regards weight and cost per egg the trial also showed the superiority of cabbage, but

the flavor and cooking qualities of the eggs from the lot fed clover were regarded as superior.

Skim milk as food for young growing chickens, W. B. ANDERSON (*Indiana Sta. Bul. 71, pp. 60–63*).—A test of the value of skim milk for chickens was made with 2 lots containing 10 Plymouth Rocks and 10 Houdans. Each lot was given all they would eat of a mixture of crushed corn, bran, and ground oats, 2:1:1. Both lots were also fed cracked bone, cabbage, and lettuce and had access to water. The amount of these articles consumed is not recorded. The two lots received the same treatment in every respect, except that lot 2 was given all the skim milk they would eat in addition to the grain ration. The test began July 11 and closed September 5. During the test one chicken in lot 1 died. Lot 1 consumed 179.8 lbs. grain, and the average weekly gain per chicken was 2.62 oz. Lot 2 consumed 217.3 lbs. grain and 90.4 lbs. skim milk, and the weekly average gain per chicken was 4.46 oz. The following conclusions were drawn:

"If skim milk be added to the ration fed to young chickens it will increase the consumption of the other foods given. The great increase in average gain was coincident with the periods when the greatest amount of skim milk was consumed. Skim milk is especially valuable as a food for young chickens during the hot, dry weather, and becomes of less importance as the chickens grow older and the weather becomes cooler."

Gravel and sand in the digestive apparatus of fowls, I. ABOZIN (*Selsk. Khoz. i Lyesor., 187 (1897), No. 12, pp. 595–604*).—Several experiments were made with hens to determine whether the gravel and sand eaten have any other function besides assisting in grinding the food. In the first test 2 sitting hens were fed buckwheat mush and sour milk but no sand or gravel. After 10 days one of the hens was killed. She had lost 202 gm. in weight. Not more than a gram of sand and gravel was found in the digestive tract, and no sand was found in the feces. The second hen was killed at the end of 20 days and dissected. She had lost 163 gm. in weight. The stomach contained 10 gm. of gravel but none was found in the feces. In both cases the bones were thin and brittle. The skeleton formed only 5 per cent of the total live weight, instead of 6 per cent, which is normal.

The test was repeated several times. In some cases the hens were fed soft foods, in other cases grain; they were given no sand or gravel. In every case the bones became thinner, more crumbly, and weighed less than normal.

The principal conclusions reached were the following: Gravel and sand are uniformly distributed throughout the food in the stomachs of fowls. This material renders the stomach contents porous and thus makes digestion more regular and also renders the passage of the food from the stomach into the intestine more rapid and easy. Gravel and sand are in large part if not entirely dissolved in the stomach of fowls and furnish nutritive material for the bones. The author discusses

at some length the conclusions of Kalugin (E. S. R., 8, p. 718).—P. FIREMAN.

Some practical applications of results of food investigations, W. O. ATWATER and A. P. BRYANT (*Connecticut Storrs Sta. Rpt. 1897, pp. 168–188*).—The practical value of food investigations is discussed and a table is given in which foods are divided into a number of groups. The different members of each group furnish nearly the same amounts of protein and energy. It is believed that such tables will prove useful in devising menus. A number of sample menus for a family equivalent to 4 persons at moderate muscular work are also given.

Fish as food, C. F. LANGWORTHY (*U. S. Dept. Agr., Farmers' Bul. 85, pp. 30*).—Statistics are given showing the importance of the fishery industry in the United States; the composition, nutritive value, and digestibility of fish are discussed, as well as its place in the diet. Sample menus are given showing that the proper amount of protein and energy may be readily furnished by a diet containing a considerable amount of fish. Some of the possible dangers from eating fish which has not been handled in a cleanly manner, or which is not properly preserved, are pointed out.

Soft clams as human food, E. CUTTER (*Dietet. and Hyg. Gaz., 15 (1899), No. 1, pp. 55, 56*).—The author believes that soft clams (*Mya arenaria*) have a high food value.

The measurement of muscular energy in man, L. HERMANN (*Arch. Physiol. [Pflüger], 73 (1898), No. 10, pp. 429–437*).—The article is based on experiments by C. Hein and T. Siebert.

The diet of laborers on the docks, P. IVANOFF (*Vestnik Obsh. Hig. Sudeb. i Prakt. Med., 31 (1896) No. 1, Pt. VIII, pp. 4–7; abs. in Rev. Hyg., 19 (1897), p. 753*).—An extended study is reported of the dietary of the laborers at the Cronstadt docks. In general it was found that they consumed from 216 to 220 gm. protein, 95 gm. fat, and 931 gm. carbohydrates, the total cost being about 13 cts. per day. During the Lenten season and other Church fasts, the amount of fat was diminished to 45 gm. per day and the carbohydrates increased to 1,040 gm. Deducting the amount of indigestible matter, the dietary was thought to furnish about the amount required by Voit's standard.

Improved forms of bomb calorimeter and accessory apparatus, W. O. ATWATER and O. S. BLAKESLEE (*Connecticut Storrs Sta. Rpt. 1897, pp. 199–211, figs. 8*).—A detailed description is given of an improved form of the bomb calorimeter described in Bulletin 21 of this office (E. S. R., 7, p. 148).

Analyses of foods, feeding stuffs, and other products, W. O. ATWATER and F. G. BENEDICT (*Connecticut Storrs Sta. Rpt. 1897, pp. 189–198*).—Analyses are reported of corn stover, oat straw, hay from mixed grasses, hay of second quality, meadow hay, oat hay, corn silage, Buffalo gluten feed, Chicago gluten meal, Rockford gluten feed, corn meal, corn and cob meal, ground oats, fine wheat feed, linseed-oil meal, rye meal, wheat bran and potatoes, and also of the food materials and feces examined in connection with the digestion and metabolism experiments with man reported elsewhere (p. 663).

Feeding of animals and the composition of a number of feeding grains, hays, and other feeding stuffs, P. BÔNAME (*Rap. An. Sta. Agron. [Mauritius], 1897, pp. 57–91*).—The author discusses the feeding of animals in general and reports the composition of a large number of feeding stuffs grown in Mauritius. Among others these include: Seeds and grains—*Mucuna atropurpurea, Dolichos lablab, Phaseolus inamœnus, Dolichos biflorus, Leucæna glauca* (whole and ground), *Cajanus*, lentils, barley, oats, maize, flaxseed, and rice. Roots, fruits, etc.—Manioc, manioc flour, cassava, arrowroot, carrots, and sugar-cane sprouts. The forage plants include: Dried sugar-cane leaves, sugar-cane sprouts, hay from a number of leguminous plants, and hay of mixed grasses. The green forage plants include: Saltbush, aloe stalks, tops and blossoms of maize, cowpeas, banana stalks, and the leaves of *Leucæna glauca, Melia azederach, Accacia lebbeck, Terantheria laurifolia, Artocarpus integrifolia*, and Telferia. An analysis of the ash of manioc is also given.

Experiments on the fermentative action of the liquid in the small intestine, F. Krüger (*Ztschr. Biol., 37 (1898), No. 2, pp. 229–260*).—The principal conclusions follow: The ferment of the mucous membrane of the small intestine did not cause cleavage of protein or fat. It saccharified cooked starch, but did not invert cane sugar.

Concerning the origin of domestic cattle, A. David (*Landw. Jahrb. Schweiz, 11 (1897), pp. 117–152, pls. 12*).—This article is based on studies of the fragments of bone found in the lake-dwelling remains of the Bielersee.

Crosses between the zebra and the horse, F. Steinriede (*Deut. Landw. Presse, 25 (1898), No. 83, pp. 885, 887, figs. 2*).—References are given to a number of such crosses.

Advantages and disadvantages of modern methods of poultry culture, S. Cushman (*Agr. Massachusetts, 1897, pp. 95–116*).—A popular address on this subject.

DAIRY FARMING—DAIRYING.

On milk "signs" in dairy cows, C. Nörner (*Milch Ztg., 27 (1898), No. 16, pp. 722–725; 47, pp. 739–741*).—The author reviews the various rules or points (*Milchzeichen*) for judging of the merits of milch cows, which have been laid down by different reputable writers from time to time. These "signs" are based upon a variety of characteristics, some on the relative size and shape of the different parts of the cow's body, others on the hair, others on the size and conformation of the udder, escutcheon, milk veins, etc. Following a summary of them, the author gives a critical discussion of their merits, based upon observations and measurements made by himself as well as on the studies of others. He concludes that most of these signs are wholly useless for judging the productiveness of a cow. He lays the most stress upon what he terms a "maternal appearance" both in bodily form and in character. The form of the udder is considered an important point, and also the size of the milk vein; but it is pointed out that a large udder is not always a sign of productiveness. "In the case of good milkers the skin of the udder has the appearance of having been dusted over with bran and has a fatty feeling." No importance is attached to the escutcheon, and this is said to be the general conclusion of European authorities.

In conclusion, the body measurements are given of the best cow in the Province of Brandenburg, as shown by a trial milking for one year. This cow was small and unsightly in appearance, and gave no external indication of so great productiveness.

Cotton-seed feed as a hay substitute for milch cows, J. B. Lindsey, E. B. Holland, and B. K. Jones (*Massachusetts Hatch Sta. Rpt. 1897, pp. 79–101*).—Two experiments are reported on the substitution of cotton-seed feed for hay, using 6 cows in each experiment. In the first experiment the commercial mixture, said to consist of 1 part of cotton-seed meal to 4 parts of hulls, was used, and in the second experiment the materials were mixed at the station in this proportion. Preliminary to the experiments 6 digestion trials of cotton-seed feed were made with sheep. The details of these trials are not given, but the average is tabulated, together with the results of similar determinations made at other stations. "The cotton-seed feed appeared to agree

better with the sheep when fed in connection with hay than when fed by itself. In the latter case, at the close of the period the sheep began to show signs of digestive disturbances, which would certainly have become quite pronounced had the feeding been continued much longer."

The first feeding experiment was made during April and May and included 2 periods of 21 days each, with a transition period. The second experiment lasted from October 6 to December 15, the time being divided into 2 periods, with a transition period of 2 weeks. In each experiment the cows were divided into 2 lots, one lot being fed the cotton-seed feed ration and the other the hay ration in the first period, and the feeding reversed in the second period. In the first experiment like amounts of cotton-seed feed and hay were fed with a constant basal ration, but in the second experiment 2 or 3 lbs. of hay was fed with the cotton-seed feed, the basal ration of grain being constant as before.

The results for the individual cows, together with the composition of the feeding stuffs and the milk, are tabulated. In computing the financial results, hay and cotton-seed feed are both rated at $15 per ton. A summary of the results of the 2 experiments is given in the following table:

Comparison of cotton-seed feed with hay for milch cows.

	Total yield of milk.	Total yield of solids.	Total yield of fat.	Digestible matter required to produce—		Average cost of food per—	
				100 lbs. of milk.	1 lb. of butter. *a*	100 lbs. of milk.	1 lb. of butter.
First experiment:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	*Cents.*
Cotton-seed feed	2,574.58	366.87	133.33	64.40	10.68	94.70	15.49
Hay	2,483.21	346.92	119.00	68.49	12.27	100.10	17.94
Second experiment:							
Cotton-seed feed	548.73	76.10	26.18	70.90	12.77	110.6	20.10
Hay	574.99	79.90	27.02	66.90	12.18	104.9	19.33
Summary of 2 experiments:							
Cotton-seed feed	5,867.00	823.50	290.4	67.65	11.72	102.6	17.79
Hay	5,933.00	826.30	281.1	67.69	12.22	102.5	18.63

a Calculated from the milk fat.

"[In the first experiment] the cotton-seed feed ration gave a slightly larger amount of milk than the hay ration. A 5.4 percentage increase in the amount of total solids is also noted, while fully 10 per cent more butter fat was produced by the cotton-seed ration. This latter result could hardly have been expected. . . . A part of the decrease in the amount of milk, solids, and fat produced by the hay ration can be accounted for in the sudden shrinkage of cow 5, . . . showing a shrinkage of 31 per cent in yield of milk [on hay] from that produced in the previous period. . . .

"[In the second experiment, with fresh cows] the results are the reverse of those obtained in the first test, the hay period yielding several per cent more milk, milk solids, and fat. Our observations of the animals from day to day during the trial indicated that the cotton-seed feed ration was falling slightly behind the hay ration. . . . The cotton-seed rations slightly increased the cost of the milk and butter."

In conclusion, the authors state that while the 2 experiments have shown cotton-seed feed to give as large milk and butter yields at as

low a cost as a good quality of hay, they believe it to require more energy for digestion than hay, and that when fed for any length of time it would have a tendency to induce digestive disturbances. It is not recommended for Massachusetts farmers in place of hay unless it can be bought cheaper than hay, in which case it is suggested that one half of the hay may be replaced by the feed.

A study of rations fed to milch cows in Connecticut, W. O. ATWATER and C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1897, pp. 17–66*).—This is a continuation of the study of rations fed by practical dairymen in the State (E. S. R., 9, p. 786), being a report for the fifth winter's work. The rations of 4 herds were studied, the period of observation lasting 12 days, and then after an interval of about 2 weeks, in which the suggested rations were introduced, the study was repeated. "The main idea was to change the feeding in such a manner as would not only give a ration with a narrow nutritive ratio, but to vary this for the different animals of the herd in accordance with their milk production." The details of the study are tabulated, and the results are discussed at considerable length. The results for the 4 herds are briefly summarized in the following table, the first test showing the rations which were being fed by the dairymen, and the second test those suggested by the station:

Original and suggested rations fed to dairy cows.

	Total amount of food.	Digestible nutrients and fuel value.					Cost.	Value of obtainable manure.	Net cost.
		Protein.	Fat.	Carbohydrates.	Fuel value.	Nutritive ratio.			
Herd J:	*Lbs.*	*Lbs.*	*Lb.*	*Lbs.*	*Calories.*		*Cents.*	*Cents.*	*Cents.*
First test	53.7	1.81	0.58	13.25	30,450	1:8.0	16.3	5.8	10.5
Second test	43.5	2.44	.73	10.75	27,600	1:5.1	14.6	6.3	8.3
Herd K:									
First test	46.8	1.76	.84	12.95	30,900	1:8.4	15.6	5.6	10.0
Second test	46.0	2.31	.88	10.74	28,000	1:5.5	14.9	6.5	8.4
Herd L:									
First test	25.8	2.11	.62	10.15	25,400	1:5.5	13.2	5.5	7.7
Second test	23.0	3.26	.73	9.10	26,050	1:3.3	13.8	7.1	6.7
Herd M:									
First test	26.8	2.12	.91	12.03	30,150	1:6.6	15.9	5.6	10.3
Second test	24.7	3.12	.84	10.84	29,500	1:4.1	15.7	6.7	9.0

"[With herd J] the average daily cost of the ration was reduced from 16.3 cts. to 14.6 cts. The average daily yield of milk was less by 0.5 lb. in the second test than in the first, but the daily yield of butter was larger by 0.05 lb. The total cost of food to produce 100 lbs. of milk was reduced 7 cts., and the cost of feed for 1 lb. of butter was reduced 3 cts. in the second test. . . .

"[With herd K] the total cost of the first ration was 15.6 cts., and of the second ration 14.9 cts. per cow per day. The second grain ration cost 0.4 ct. per day more than the first, while the coarse fodders cost about 1 ct. less in the case of the second ration. The average milk yield was essentially the same in each of the tests, while the yield of butter fat was 0.07 lb. more per day in the case of the second ration. . . .

"The second ration [of herd L] was an exceptionally heavy one in protein, [and] the herd had larger quantities of protein than are there recommended for cows with

a corresponding milk flow. Notwithstanding the heavy protein ration fed, the average milk flow for the 9 cows in the second test was 1.3 lbs. per day greater than in the first test, while the cost of the second ration was 0.6 ct. more per day. This farmer was producing milk for the Boston market, and at the average price (3 cts. per quart) the increase in milk flow in the case of the second ration more than covered the additional cost. For most of the cows, however, the increase was very slight, and we are inclined to doubt if the feeding of as large quantities of protein as were here used would be economical, except in the case of very heavy milkers. . . .

"The ration fed [to herd M] in the first test was as heavy and as large in protein as is commonly recommended for cows of this weight. The protein was purposely increased by a large amount (1 lb. per day) in the second test, and the nutritive ratio was thus made quite narrow. Both rations seem to have been well eaten by the cows, although the milk flow in the second test for some reason dropped off to an unusual degree. The general tendency of rations high in protein in nearly all of our experiments has been to keep up the milk flow and lessen the natural shrinkage. The average percentage of butter fat in the second test was increased by 0.4 per cent. This made the total yields of butter fat about equal in the two tests. The total cost of the second ration was slightly less than that of the first ration. For the production of milk this second ration, however, proved unprofitable."

During the five seasons' work 45 rations have been studied. These included "32 which were found in actual use by some of the more intelligent and successful dairymen in the State, and 13 rations which were proposed by the station to test the effect of larger amounts of protein than those used by the feeders. These 13 tests with the narrower rations were made after the studies of the actual feeding practice in the same number of cases." The result of these studies are variously summarized in tables.

Averages of rations fed by Connecticut dairymen, with daily yields of milk and butter and percentages of fat.

Rations.	Digestible nutrients and fuel values.					Daily milk yield.	Average fat content of milk.	Daily butter yield. *a*
	Protein.	Fat.	Carbohydrates.	Fuel value.	Nutritive ratio.			
	Lbs.	*Lb.*	*Lbs.*	*Cal.*		*Lbs.*	*Per ct.*	*Lbs.*
Average of all the rations (45)	2.08	0.72	11.21	27,750	1:6.5	17.6	4.8	0.97
Average of 32 rations found in actual practice	1.97	.73	11.57	28,250	1:7.0	17.5	4.8	.96
Average of rations containing 2 pounds or less of digestible protein per day, as fed 16 herds (226 cows) in actual practice	1.62	.65	11.37	26,900	1:8.1	16.3	4.7	.87
Average of rations containing more than 2 pounds of digestible protein per day, as fed 16 herds (227 cows) in actual practice	2.32	.81	11.77	29,600	1:5.9	18.7	4.9	1.05
Average of 11 wide rations (first test) as found in use	1.78	.64	11.86	28,100	1:7.7	18.0	4.7	1.00
Average of 11 narrower rations (second test) proposed by the Station	2.40	.67	10.37	26,600	1:5.1	18.2	4.9	1.04

a Calculated.

"The 45 rations as fed contained from 1.15 to 3.26 lbs. of digestible protein, averaging 2.1 lbs.; and the fuel values ranged from 21,150 to 35,150 calories, averaging 27,750 calories. The nutritive ratios ranged from 1:3.3 to 1:11.3, with an average of 1:6.5. . . .

"In the 32 tests of actual feeding practice the average ration per cow per day supplied from 1.15 to 2.70 lbs., averaging 2 lbs. of digestible protein; while the range of fuel values was from 21,150 to 35,150, averaging 28,250 calories. The nutritive ratios of these rations ranged from 1:4.5 to 1:11.3, averaging 1:7.0. . . .

"The advantage of rations with liberal quantities of protein is quite clearly shown when the herds are divided into two groups according to the amounts of protein in the rations fed. The group composed of those herds receiving 2 lbs. or less of digestible protein per cow per day produced on the average 16.3 lbs. of milk and 0.87 lb. of butter per day, while the group receiving more than 2 lbs. of digestible protein per cow per day averaged 18.7 lbs. of milk and 1.05 lbs. of butter. This means that the herds which were fed the larger quantities of protein produced on the average 15 per cent more milk and 20 per cent more butter per cow than those fed the smaller quantities of protein. . . .

"It is impracticable to compare accurately the costs of the rations fed throughout these 32 tests, but the general results of our experiments indicate that the rations with relatively large proportions of protein are cheaper than those containing relatively smaller quantities. . . .

"Our studies tend to point more and more to the conclusion that rations should be compounded in accordance with the milk flow rather than in accordance with the live weight of the animals. If the milk flow is uniform, the feed need not vary much for variations of 100 to 200 lbs. live weight, but with an increase in the milk flow the size of the ration should be larger, and especially the protein should be increased both in total quantity and relatively, in order to meet the increased demands on the system of the animal."

Nitrogenous feeding stuffs, and feeding formulas for dairy cows, W. O. ATWATER and C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1897, pp. 67–129*).—This is quite a general article discussing the food supply of the farm, composition and digestibility of feeding stuffs, energy required for digestion, food requirements of the animal organism, manurial value of nitrogenous feeding stuffs, influence of food upon the composition of cows' milk, with a summary of experiments on this point made by different stations, and feeding standards or formulas.

The conclusion from the experiments summarized on the effect of food on milk is that—

"Liberal amounts of protein and narrow rations tend to increase the flow of milk and to lessen the natural shrinkage due to advanced period of lactation.

"As to the influence of nitrogenous feeding stuffs on the composition of milk, the results of the majority of the experiments here reported indicate that the narrow rations tended to increase the percentages of total solids and of fat in the milk to a slight degree. A rise of from 0.2 to 0.6 in the average percentages of fat in milk in favor of the narrow rations is seen in at least 4 of the experiments recorded. The individuality of the cow, however, seemed to be an important factor. While in the case of some cows a considerable change in the percentage of solids and of fat was noticed, in other cases there seemed to be little or no change.

"The percentages of fat in the total solids of the milk was larger in at least 4 of the experiments where the narrow rations were fed—that is, the proportion of fat to solids-not-fat seemed to be increased in these instances by the use of narrow rations.

"With regard to the relative profit from the use of the narrow and the wide rations, there seems to be a diversity of opinion, but the general verdict of the experiments here recorded is in favor of the liberal use of nitrogenous feeding stuffs from the standpoint of profit, especially in the Eastern States."

The effect of some undetermined factors in experiments of this kind, as short periods and the total quantity of food, is considered, and the application and importance of metabolism experiments in the study of this question is emphasized.

The question of feeding standards is discussed at considerable length and the point is made that "a physiological standard or a formula for profit to feed in all cases is not only irrational but impossible." It is believed that the amount of food should be varied in proportion to the milk yield and to suit the stage of lactation. In accordance with this belief 6 rations are proposed "with the plan in view of utilizing home-grown nitrogenous feeding stuffs and of supplementing these mainly by the addition of concentrated nitrogenous feeds, the latter to be increased in accordance with the milk production." In the case of each ration a basal ration is given for cows producing from 10 to 20 lbs. of milk per day. For all cows giving over 20 lbs. of milk per day there is added to this basal ration 1 lb. of a protein mixture (furnishing 0.3 lb. of digestible protein) for each 5 lbs. increase in the milk flow. The rations are calculated for cows weighing from 750 to 950 lbs. and would probably require to be increased for heavier cows. In the case of each ration the components of the basal ration and the protein mixture, with the amounts of digestible nutrients furnished, are given. The rations are adapted to different conditions with respect to the feeding stuffs grown on the farm.

Dairy rations, F. L. KENT (*Oregon Sta. Bul. 51, pp. 12–16*).—Four cows were fed for periods of 15 days each on the following rations:

Ration 1. Corn silage 25 lbs., clover hay 10 lbs., bran 6 lbs.
Ration 2. Corn silage 25 lbs., clover hay 10 lbs., bran 5 lbs., oat chop 3 lbs
Ration 3. Corn silage 40 lbs., clover hay 5 lbs.
Ration 4. Clover hay 15 lbs., bran 5 lbs., oat chop 2 lbs., carrots 8 lbs.
Ration 5. Clover hay 15 lbs., bran 5 lbs., oat chop 3 lbs., shorts 2 lbs.

"Of the 5 rations fed, No. 1 . . . is shown by the tables to be the most satisfactory. The cost of a pound of butter fat is low, only 10.4 cts. at a time when butter was worth 25 cts. per pound in the market. . . . In rations 1 and 2, where silage was fed in connection with grain and hay, butter fat was produced at a cost of 10.4 cts. and 12.8 cts. respectively. In rations 4 and 5, where the silage was omitted and larger quantities of hay and grain fed, the cost per pound of butter fat was 16.1 cts. and 17.4 cts. respectively."

Root feeding, F. L. KENT (*Oregon Sta. Bul. 51, pp. 17–19*).—Feeding a constant basal ration of clover hay, silage, and grain, a comparison was made of beets, carrots, and mangel-wurzels, feeding about 24 lbs. of each. Each ration was fed to 4 cows for 4 weeks. There were no differences in the yield and cost of butter fat on the 3 rations which could be attributed to the different root crops.

"Very little difference was noticeable in the quality of the butter from the different rations, especially between the rations consisting largely of carrots and sugar beets. That from the ration consisting largely of mangels was not quite so high in flavor, however, as the butter from the other 2 rations."

Experiments on the effect on butter of feeding cotton-seed and sesame-oil cake, T. E. THORPE (*Analyst, 23* (*1898*), *Oct., pp. 255–259*).—These experiments were made for the British Board of Agriculture by the Southeastern Agricultural College at Wye, "for the purpose of determining whether and to what extent the substances giving the cotton-seed and sesame-oil reactions might be found in the butter made from the milk of cows fed on cotton-seed and sesame-oil cakes."

Twelve cows were fed in 4 lots during 6 periods, commencing February 16 and ending May 25. A part or the whole of the linseed cake in the basal ration was replaced in different periods by cotton-seed cake or sesame cake, as high as 7 lbs. of each being fed per cow daily, which was the limit to the amount the cows would eat. Butter was made from the milk and samples were tested for the cotton-seed oil and sesame oil reactions. They were also compared with butter made with the addition of 1, 2, and 5 per cent of 4 representative samples of cotton-seed oil.

The general conclusions from the experiment are summarized as follows:

"(1) Cows fed on cotton-seed oil cake produce milk the butter fat of which gives cotton-seed oil reactions.

"(2) The reactions appear when the cows receive only a small quantity of cake. They increase somewhat with continuous feeding, but apparently can not be carried beyond a certain point, even when the amount of cake is increased to the full limit which the cows under ordinary circumstances care to eat.

"(3) The reacting substance passes into the milk within less than 24 hours after the cake feeding begins, and continues to do so for several days after it has been dropped.

"(4) The reactions vary in intensity in individual cows, but do not in any case much exceed those given by 1 per cent of cotton-seed oil mixed with butter. The presumption is, therefore, that in butter made in the ordinary way from the mixed milks of several cows the reaction would, as a rule, be less than that due to the presence of 1 per cent of the oil, and experiment shows that this is actually the case.

"(5) As feeding with cotton-seed oil cake gives butter affording analytical data tending to differ from rather than to approach to those given by margarine, it appears to be possible in most cases to differentiate between the cotton-seed oil reaction due to feeding on cotton-seed oil cake and that produced by any considerable admixture of margarine containing cotton-seed oil with butter.

"(6) The butter from the milk of cows fed on sesame-oil cake gives no sesame-oil reaction, even after more than 5 months' continuous feeding up to as large a quantity as the cows will take."

The changes in butter due to feeding fat, G. BAUMERT and F. FALKE (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 10, pp. 665–678*).—This experiment was made at the agricultural institute at Halle. Two cows were fed from January 17 to May 7, 1897, in 5 periods of 20 days each, the first half of each period being regarded as preparatory. A constant basal ration was fed throughout the experiment. To this was added per cow 700 to 900 gm. of sesame oil in the second period; 550 to 700 gm. of cocoanut oil in the third period, and 500 gm. of almond oil in the fourth period. The oil was given as in Soxhlet's experiments (E. S. R., 8, p. 1016), in the form of an emulsion as a warm drink. Sweet

cream butter was made from the milk of each cow daily. No data are given as to the yield and composition of the milk, but the results are tabulated of the examination of 32 samples of butter produced in the first period, 44 in the second period, 36 in the third period, 34 in the fourth period, and 32 in the last period. The results are summarized in the following table:

Butter produced on basal ration and with the addition of sesame, cocoanut, and almond oils.

Period.		Melting point of butter.	Index of refraction.		Köttstorfer number.		Volatile fatty acids.		Iodin number.	
			Of oil fed.	Of butter.	Of oil fed.	Of butter.	Of oil fed.	Of butter.	Of oil fed.	Of butter.
		Deg. C.								
1	Basal ration:									
	Swiss cow	34.16	....	+1.7	....	224	....	31.0	....	44.3
	Dutch cow	33.96	....	+2.4	....	223	....	29.5	....	45.0
2	Sesame oil:									
	Swiss cow	37.00	+17.6	+5.6	190	204	0.4	16.9	116	53.9
	Dutch cow	36.76	+17.6	5.4	190	206	0.4	15.7	116	52.9
3	Cocoanut oil:									
	Swiss cow	33.58	− 9.2	−0.5	255	237	8.0	20.0	9	37.1
	Dutch cow	34.76	− 9.2	−0.6	255	230	8.0	18.6	9	35.2
4	Almond oil:									
	Swiss cow	34.28	+13.6	+3.6	195	210	0.0	19.7	98	50.9
	Dutch cow	34.50	+13.6	+4.3	195	207	0.0	15.3	98	53.9
5	Basal ration:									
	Swiss cow	34.50	....	+3.0	....	218	....	22.0	....	41.2
	Dutch cow	35.15	....	+3.6	....	216	....	24.4	....	44.5

The sesame oil had a marked influence on the appearance and taste of the milk and increased the index of refraction, diminished the Köttstorfer number and the volatile fatty acids, and increased the iodin number of the butter. A test for sesame oil with furfurol and hydrochloric acid gave no reaction. The butter produced on cocoanut oil was normal in appearance, but had an unmistakable taste of cocoanut oil. The index of refraction of the butter was materially diminished, the Köttstorfer number was materially and the volatile fatty acids slightly increased, and the iodin number was noticeably diminished. On almond oil the butter showed a positive increase in the index of refraction, the Köttstorfer number diminished slightly, and the iodin number increased.

The authors conclude that the feeding of oils not only greatly changed the butter, but that the changes followed in general the characteristics of the oils themselves. "In other words, in feeding sesame oil, cocoanut oil, and almond oil butter fat was produced which corresponded in its chemical properties to artificial mixtures of butter with these 3 oils." The authors go so far as to say that in the light of the above investigations the feeding of such oils would constitute "an adulteration of the butter within the animal's body."

Fresh vs. stripper cow butter, F. L. KENT (*Oregon Sta. Bul. 54, pp. 20, 21*).—In an experiment of about 5 days' duration the milk of 11 cows averaging 121 days from calf was compared with that of 4 cows averaging 283 days from calf.

"So far as this short experiment goes, it shows that the milk from comparatively fresh cows gives up its cream more readily even with a separator than does milk

from cows well along in the period of lactation. It also shows that butter made from the milk of cows which have been in milk for a considerable period of time is slightly inferior to that made from the milk of cows which are comparatively fresh."

A few experiments concerning the hardness of butter, H. ATWOOD (*West Virginia Farm Review, 6 (1898), No. 11, pp. 355, 356*).—Fifty-two and one-half pounds of sweet Cooley cream was divided into 2 equal parts, one being warmed gradually to 56° and churned and the other warmed gradually to 65°, kept at that temperature 2 hours, and then churned. It was found that the butter from the cream churned at 65° came and remained softer than that from the cream churned at 56°. The hardness of the butter was determined by dropping a small glass tube filled with mercury upon the butter and observing the penetration. In another experiment both lots of cream were warmed considerably above the proper churning temperature and then cooled quickly. One part was churned at once and the other was allowed to remain at the proper churning temperature for 4½ hours and then churned. "The butter from the cream which was churned immediately after being cooled came softer and remained softer than the other."

Studies on the formation of holes in Emmenthaler cheese, O. JENSEN (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 6, pp. 217-222; 7, pp. 265-275; 8, pp. 325-331*).—The author reviews the theories in regard to the cause of these holes and reports investigations to test their accuracy. The conclusions which he reaches are as follows: (1) The normal holes in Emmenthaler cheese are not produced by the same agents as swelling or by yeasts or obligate anærobic bacteria, but by the agents which cause normal ripening, i. e., lactic-acid producing organisms. (2) The gas which is the immediate cause of the holes is not produced at the cost of the milk sugar, but from the nitrogenous substances. (3) The lactic-acid organisms of cheese can, under certain conditions, form traces of carbon dioxid from nitrogenous substances, and these traces are the cause of the normal formation of holes in Emmenthaler cheese.

The cause of the ripening of Emmenthaler cheese, E. VON FREUDENREICH (*Landw. Jahrb. Schweiz, 11 (1897), pp. 85-101; and Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 5, pp. 170-174; 6, pp. 223-230; 7, pp. 276-281*).—Two cheeses were examined bacteriologically with results similar to those found on previous occasions. Numerous lactic acid micro-organisms were found, with only a few liquefying organisms. Experiments in inoculating Duclaux' liquefying organism, tyrothrix, into cheese, showed as formerly that the organism can not increase in cheese but, on the contrary, decrease in numbers. Various experiments are reported with cheese made from pasteurized milk which was inoculated with cultures of lactic-acid bacteria, liquefying bacteria, and anærobic bacilli. These experiments, the author concludes, indicate that the lactic-acid organism plays a principal rôle in the ripening of cheese, since ripening took place when the lactic-acid organisms were

used alone or combined with other forms, and the cheese did not ripen with the liquefying bacilli alone.

As the pasteurized milk was not entirely free from micro-organisms, experiments were undertaken with milk which was obtained under the greatest precautions in the hope of securing aseptic milk. This milk was found, however, to contain from 92 to 500 bacteria per cubic centimeter. The cheese molded, although it was kept under a sterilized bell glass, and was then scraped and dipped in a solution of paraffin, which, in some cases, promoted the growth of an anærobic bacillus. This, however, is not believed to have interfered with the experiment. "These experiments indicate anew that the ripening of cheese is invariably associated with the presence of lactic-acid organisms and under the exclusion of so-called tyrothrix bacilli; the latter were not to be found in the ripened portion of the cheese or on the surface."

Studies were then made on the effect of lactic acid in changing the casein, to determine definitely whether the change in the casein was due to the action of the lactic organisms or to the acid produced. The lactic acid produced in the milk cultures was neutralized by calcium carbonate, the bottles being frequently shaken for this purpose. The results showed that the change in the casein could not be attributed to the action of lactic acid.

Finally the results are recorded of 12 experiments in inoculating into milk various pure cultures of micro-organisms isolated from cheese.

The author's final conclusion is that the lactic-acid organisms, especially those isolated from cheese, are able to dissolve and decompose casein, and that there is no further ground for doubt that the cause of the ripening of hard cheese is to be found in the lactic organisms. He suggests that, knowing the cause of the ripening, a practical application may be made as has been done in butter making in using pure cultures for ripening cream.

The fungi taking part in cheese ripening, O. JOHAN-OLSEN (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 5, pp. 161–169, pls. 6*).—The author gives a condensed account of his studies on the cause of the ripening of Gammelost, a Norwegian cheese made from pasteurized skim milk, and the use of a mixture of pure cultures in the manufacture of this cheese. From the various forms of micro-organisms found in different samples of the cheese, it was found by practical experiments extending over quite a period that the best results were obtained by the use of pure cultures of lactic-acid organisms from Gammelost cheese, *Chlamydomucor casei*, *Mucor casei* I, and *Penicillum aromaticum casei*. The character of the cheese could be changed at will by partial changes in the organisms used. The method of making the cheese by the old and the new ways is described. The cheese made with the pure cultures was much more uniform in quality, kept better, had a finer flavor, and a less objectionable odor. The ripening can be so well regulated that less than 10 per cent of the cheeses are inferior. These pure cultures are

coming to be used in practice, about 15,000 kg. of Gammelost being made with pure cultures the past year, it is estimated.

In a similar way the author has worked out pure cultures for making Gorgonzola, Camembert, Roquefort, and Fromage Norwegian cheeses, although these are not described in the article.

The action of rennet ferment, E. VON FREUDENREICH (*Landw. Jahrb. Schweiz, 11 (1897), pp. 102–116; and Centbl. Bact. u. Par., 2. Abt., 4 (1898), No. 8, pp. 309–335*).—In order to obtain germ-free rennet the author made experiments with the use of various antiseptics, i. e., chloroform, potassium bicarbonate, thymol, salol, glycerin, and formic aldehyde. An artificial preparation of rennet in the form of rennet tablets was used. An aqueous solution of formic aldehyde (0.5 to 1 per cent) was the only disinfectant which gave satisfactory results. Chloroform did not diminish the action of the rennet but failed to sterilize it completely. Potassium bicarbonate in 0.005 solution did not sterilize and materially weakened the action of the rennet. Thymol sterilized the preparation but prevented the action of the ferment. The same was true of formic aldehyde vapor.

The best means of preparing a germ-free rennet was found to be filtering it through a Chamberland porcelain filter. This weakens the action of the rennet solution somewhat, which can be remedied by starting with a stronger solution. The strength of this filtered rennet solution was weakened by keeping.

Experiments were made with this germ-free rennet on the curdling of pasteurized milk, the milk being heated for different lengths of time at from 68 to 90° C. Milk heated to 68° for 15 minutes curdled well with rennet, but if the heating was continued for an hour the curdling was materially diminished, although not entirely prevented. Continued heating at 70° or over had a decidedly unfavorable effect upon the curdling. The conclusion is that where it is desirable to pasteurize milk it may be done without spoiling the milk for cheese making.

Dairy bulletin by the Dairy School, Guelph (*Ontario Agr. Col. and Expt. Farm Bul. 107, pp. 32*).—A popular bulletin on methods of disposal of sewage from creameries and cheese factories, the testing and handling of milk, and the making of butter and cheese.

Report on the chemical examination of two hundred individual specimens of human milk, V. ADRIANCE and J. S. ADRIANCE (*New York, 1898, pp. 42; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 7, pp. 686*).

Composition and food value of cheeses, BALLAND (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 22, pp. 879–881*).—A brief extract of a paper presented before the society.

Milch cows, structure as relating to production, G. M. TWITCHELL (*Agr. Massachusetts, 1897, pp. 23–37*).—This is a popular paper delivered before the Massachusetts Board of Agriculture on the importance of type in the selection and breeding of dairy cows.

The source of milk fat, R. WARINGTON (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), pt. 2, No. 34, pp. 317–323*).—This article consists principally of a review of the experiment in milk production on fat-free food at the New York State Station (E. S.

R., 9, p. 1083), from which the author concludes that "the dairy farmer need no longer feel the necessity for supplying his cows at all costs with a highly nitrogenous diet; a liberal ration of cereal corn, including bran, is apparently sufficient to yield a full supply of milk and butter."

Is the fat of the food directly transmitted to the milk? WINTERNITZ (*München. Med. Wchnschr., 44 (1897), No. 30; abs. in Ztschr. Fleisch und Milchhyg., 8 (1898), No. 11, p. 209*).—The author fed iodin fat to a goat and examined the milk for iodin. The results, he believes, indicate that the food fat is transmitted to the body fat or milk.

Abnormal milk (*Milch Ztg., 27 (1898), No. 48, p. 760*).—A cow at the agricultural academy at Poppelsdorf, in the last stages of lactation, gave milk with from 6.5 to 7 per cent of fat. When she was nearly dry she gave 60 gm. of milk at night and 100 gm. in the morning which contained 42.1 per cent of solids, 25.57 per cent of fat, 16.53 per cent of solids-not-fat, and 2.32 per cent of sugar. She was found unsound when slaughtered.

Milk supply and the public health, W. T. SEDGEWICK (*Agr. Massachusetts, 1897, pp. 46–54*).—This is a popular paper delivered before a public meeting of the Massachusetts Board of Agriculture, in which the character and sources of milk contamination are discussed and suggestions made on the production and handling of milk from a sanitary standpoint.

The present status of the "milk ice" question (*Milch Ztg., 27 (1898), No. 49, p. 776*).—A commission sent by the Mark Brandenburg to investigate the milk ice trade in Copenhagen (E. S. R., 9, p. 581) reports that at present about 18,000 liters are sold daily. There has been no difficulty in introducing milk ice, but on the contrary the demand at times has exceeded the supply. It is preferred to other milk by the customers because the chilling as soon as possible after milking preserves the original aroma and hinders the action of micro-organisms. It is of advantage to dealers, as surplus milk can be stored for some time and used as needed.

Why milk sours and how souring can be prevented or at least delayed, G. M. WHITAKER (*Agr. Massachusetts, 1897, pp. 48–53*).—This treats in a popular manner of the souring of milk and the value of cleanliness and prompt cooling as preventives.

Pasteurization of milk, F. E. EMERY (*North Carolina Sta. Bul. 148, pp. 300–304, fig. 1, dgm. 1*).—A popular explanation of pasteurization with an illustrated description of a pasteurizing apparatus devised at the station. The apparatus consists of a large galvanized iron box with a rack for supporting the jars or cans and heated by live steam or a stove. A diagram shows the temperature of the milk and the water in the box during two trials.

The effect of several substances on the curdling of milk, T. BOKORNEY (*Milch Ztg., 27 (1898), No. 49, pp. 769, 770*).—Experiments with a number of common and some new milk preservatives. Most of the new substances were ineffective.

Observations on the ripening of cream, W. GRANSKY (*Milch Ztg., 27 (1898), No. 47, pp. 741–742*).—Data covering a little over 2 weeks, collected at the dairy institute at Hameln.

Effect on the quality of butter of feeding oil cakes (*Milch Ztg., 27 (1898), No. 46, pp. 721–722*).—An account of English experiments noted elsewhere (p. 685).

Cost of production of butter, T. L. HAECKER (*Wisconsin Dairymen's Assoc. Rpt. 1898, pp. 127–142*).—A popular address.

VETERINARY SCIENCE AND PRACTICE.

Preliminary report upon a comparative study of tubercle bacilli from man (sputum) and from cattle, T. SMITH (*Agr. Massachusetts, 1897, pp. 564–581*).—The author's observation that there were differences in the lesions produced in guinea pigs by the inoculation of tubercular products of cattle and from the sputum of human beings

led to an extended investigation of the subject. Some of the earlier experiments have been previously reported.[1]

In the present publication 12 experiments with cattle are described in considerable detail. Six animals were inoculated with human bacilli, 5 with bovine bacilli, and 1 with swine bacilli. In all cases cultures isolated by the author were used. Inoculations were first made on guinea pigs, and from them after 3 to 6 weeks cultures on dog serum were made. These were tested upon rabbits and guinea pigs and lastly on the cattle. In all the tests the experimental conditions were kept as nearly uniform as possible. Of the 6 cases inoculated with bacilli from sputum 1 showed no disease, 2 very slight lesions, and 3 only local lesions without dissemination. Of the 5 cases inoculated with bovine bacilli, 2 died of generalized disease, 2 showed extensive lesions, and 1 less extensive lesions. The animal inoculated with swine bacilli, which the author remarks were probably originally bovine, showed less extensive lesions than the animals inoculated with bovine bacilli.

"We may now maintain that bovine tubercle bacilli and human bacilli as found in sputum are not identical. The difference in their action upon cattle is reinforced by certain differences in the bacilli themselves and their effect upon rabbits. . . .

"What the significance of these divergencies is, what influence they have upon the transmissibility of the disease from cattle to man, we are unable at present to state with any degree of certainty. That they do have some effect must be admitted in view of results of studies upon other species of pathogenic bacteria. Their precise bearing needs careful investigation.

"These studies will, I think, warrant one inference, however; that is, that human sputum can not be regarded as specially dangerous to cattle, nor can it be looked upon as a factor in the introduction of tuberculosis into a healthy herd of cattle. Even if the tubercle bacilli of cattle and of man are very closely related and have the same ancestry, as we all must admit, if we regard the two as mere varieties, which may eventually, under very favorable conditions, pass one into the other, the condition in which the bacillus leaves the lungs in sputum is evidently such as to interfere, under ordinary circumstances, with any development in the bovine body. It would fall a speedy prey to destruction.

"I refrain, for obvious reasons, from drawing the conclusions that all human tubercle bacilli are like those existing in the sputum of phthisis."

A comparative study of bovine tubercle bacilli and of human bacilli from sputum, T. SMITH (*Jour. Exptl. Med., 3 (1898), No. 4–5, pp. 451–511*).—In this publication the author describes the experiments noted above, and in addition reports comparative tests of bovine tubercle bacilli and bacilli from human sputum upon rabbits, gray mice, and pigeons.

"The foregoing experiments, while they show unmistakably the close relationship existing among the various cultures studied, nevertheless justify us, if only to guide and stimulate further study, in establishing a distinctively human or sputum and a bovine variety of the tubercle bacillus. . . . The characters upon which the bovine variety may be based reside, morphologically, in the invariably short, straight

[1] Trans. Assoc. Amer. Physicians, 1896, pp. 75–93. U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1895–96, pp. 149–161 (E. S. R., 9, p. 889).

form, and in the greater resistance of this form to modifying influences of culture-media; biologically, in a greater resistance to artificial cultivation and in a much greater pathogenic activity toward rabbits, guinea pigs, and cattle.

"There is proof, furthermore, of the existence of slightly varying characters even within the varieties proposed. Among the bovine forms studied slight variations in virulence were noticeable. Among the sputum forms, variations in size, in capacity for cultivation, and in pathogenic activity have been observed. . . . In spite of these variations, mammalian tubercle bacilli may still be considered as forming a fairly compact group when compared with the tubercle bacilli of birds, which are but slightly virulent toward the guinea pig, so susceptible to the mammalian type. . . . The bovine type differs from the human bacilli in a far less saprophytic growth. In the pathological secretion and in the caseous masses the bacilli are relatively scarce. This difference may be a result of their adaptation to the bovine body, in which cavities of the lungs and catarrh of the air tubes are far less common. In other words, certain differences in the type of reaction tend in the one case to make the human bacillus more saprophytic, the bovine more parasitic."

A study of normal temperatures and the tuberculin test, C. E. MARSHALL (*Michigan Sta. Bul. 159, pp. 347–396*).—A general discussion of tuberculin and its use is followed by a detailed report of a study of the variations in normal temperature of cattle and a comparison of these results with the variations in temperature after injecting tuberculin. It was found that normal maximum temperatures varied from a fraction of a degree to over 5°.

"Owing to this great variation in normal maximal temperatures, we feel justified in bidding caution to all operators in the tuberculin test. The too prevalent method of finding the maximal temperatures of the day of and the day after injection and condemning animals in accordance with this standard, without any further investigation, may be the means of unnecessary destruction of property. There are cases where this would be legitimately allowable, as we shall see later in a survey of reactions, but when it is applied irrespective of other features it can not be justified. Where there is a possibility of 5° of variation in normal maximal temperatures, 2° can not be taken as the sole criterion for placing the stamp of 'tuberculous' upon an animal."

Sudden changes in temperature, the influence of seasons or atmospheric temperature upon the temperature of animals, time of day when maximum and minimum temperatures occur, and whether temperatures higher or lower occur on the second day of the test are also discussed with reference to the temperature records kept at the station.

In summarizing the discussion the following tentative conclusions are advanced:

"(1) Tuberculin is the best diagnostic known for tuberculosis.

"(2) Tuberculin itself may be infallible, but its application and interpretation are not.

"(3) An arbitrary point of condemnation is unwarranted.

"(4) To succeed in eradicating tuberculosis from a herd, the tuberculin test must be applied persistently at intervals for as yet an undetermined time.

"(5) The slaughtering of animals reacting to tuberculin is not justified, unless the physical condition of the animal confirms the tuberculin test and makes it a wise precaution. Reacting animals should be isolated. Should a second test diagnose tuberculosis, slaughter is possibly made justifiable unless the animal is sufficiently valuable to isolate her for offspring or in hopes of recovery."

Tuberculous cows and the use of their milk in feeding calves, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1897, pp. 243–251*).—The record for 2 years is given of 4 Devon cows which were condemned by the State Cattle Commission as tuberculous. At different times during the period the cows responded to the test and at other times they failed to respond. A statement of the veterinarian as to the present condition of the cows is given. Good care and treatment evidently prevented the development of the disease in these cases. Four calves from healthy cows were fed for periods of 5 to 16 months upon the milk of the 4 cows supposed to be tuberculous. The disease had not appeared in the udder of any of the cows. "In no instance do these calves show symptoms of the disease either by the tuberculin test or physical examinations."

Some diseases of animals caused by improper feeding, J. F. CONNOR (*Alabama Canebrake Sta. Rpt. 1897, pp. 13–15*).—The author discusses the symptoms and treatment of acute gastro-intestinal catarrh, colic due to overloading the stomach, and flatulent colic. The fact is emphasized that care should be taken not to overload the stomachs of horses and mules. They should not be fed immediately before starting on a long journey. Care should be taken not to feed moldy corn.

"Horses and mules should be fed 3 times a day and from separate mangers. The amount of food required by each animal can only be determined by observation by those in charge. Oats and corn mixed make a good food. This, with plenty of clean hay or fodder and an occasional bran mash (when there is a tendency to constipation) will keep the animal in good condition."

Relation of water supply to animal disease, A. W. BITTING (*Indiana Sta. Bul. 70, pp. 42–51, figs. 3*).—The amount of water which different animals consume is discussed.

"The diseases which arise as a result of supplying water in insufficient quantities, or not providing water in accessible places, are sporadic in character; that is, affect only an occasional animal or a few in a herd or flock. Probably the most serious disease having such cause is mad itch in cattle. This occurs especially in the fall of the year, when the cattle are upon dry pasture, or when turned in upon a dry stalk field. It may occur at other times, and also be due to other causes, but without doubt 90 per cent of the cases occurring in this State are directly traceable to this cause. Sheep also suffer from impaction and constipation, and large numbers die for want of proper water supply. Hogs, especially young ones, often succumb from like treatment. Horses probably suffer least loss, because they receive the greatest care in this respect, but no doubt many cases of colic, impaction, and constipation are traceable to this source."

The author notes that the dangers of diseases which arise from insufficient water are much less numerous than those due to supplying impure water. The possibility of infection with animal parasites and diseases conveyed by impure water is discussed at some length.

Blood serum in the prevention and treatment of infectious swine diseases, with a report of an experiment with swine plague antitoxin, V. A. MOORE (*Proc. Soc. Prom. Agr. Sci., 1897, pp. 26–34*).—Serum therapy in infectious swine diseases is discussed at some length.

In a test reported the presence of the disease in the herd was demonstrated by inoculation of rabbits. Eleven animals were treated. Of these 8 were sick when given the serum. Six died. Later 13 others were treated with injections of serum. Of these 8 were sick at the time of treatment and 5 died. Of the total number of animals treated, 11 died and 14 survived.

"It is difficult to draw further conclusions from this experiment or the results of others herein referred to. Just what the action on the animal body of the toxin injected is, by which it is converted into an antitoxin, has not as yet been satisfactorily explained. The investigations have not advanced sufficiently to enable us to say what species of animals will furnish the best antitoxin, but if it is to become practicable it seems that it must be one of the larger, such as the cow or horse. The question has also arisen, whether or not the method will be practicable even if the serum can be made efficient. To this a positive answer can not be given, but it seems highly probable that it can. It is easily administered, and the cost of its preparation ought not to preclude its use. It is suggested by the work on guinea pigs that the serum for hog cholera and swine plague can not be made interchangeable; neither can they be made a specific for dietary and filth diseases. These must be eliminated by the introduction of better sanitary methods. From the successes reported from serum therapy in other diseases it is reasonable to expect that eventually we may have antitoxins for the bacterial diseases of swine. Certainly the results of the experiment just described indicate that the investigations along these lines are more promising than any others which have been proposed for the discovery of a specific for swine plague."

Bacillus anthracis similis, J. McFarland (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 15–16, pp. 556, 557*).—A description is given of a bacillus cultivated from an abscess, the organism greatly resembling that causing anthrax.

On the production of Pasteur's vaccine for anthrax, J. Mendez (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 17, pp. 616–619*).—Directions are given for the preparation and use of this vaccine.

Cattle tuberculosis: A practical guide for the farmer, butcher, and meat inspector, T. M. Legge and H. Sessions (*London: Baillière, Tindall & Cox, 1898, pp. 78, ill.*).

Acute pulmonary tuberculosis in the horse, H. Thompson (*Vet. Jour., 1898, July, pp. 21–23; noted in Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 11, p. 430*).

The malignant foot disease of sheep, Martens (*Berlin. Klin. Wchnschr., 1898, No. 45, pp. 529–531*).

Foot and mouth disease in sheep and goats, Himmelstoss (*Wchnschr. Tierheilk., 1898, No. 37, pp. 341–344; 38, pp. 349–353*).

Report of the commission appointed to investigate the hoof and mouth disease, Loeffler (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 15–16, pp. 569–574*).—This is the fourth report of the commission of the Institute for Infectious Diseases at Berlin.

The sturdy, or staggers, of sheep, R. Cassirer (*Arch. Path. Anat. u. Physiol. [Virchow], 153 (1898), No. 1, pp. 89–110*).—Pathological, anatomical, and bacteriological studies were made of this disease.

African hæmoglobinuric fever, commonly called black water fever, R. M. Connolly (*British Med. Jour., 1898, No. 1969, pp. 882–885*).

Poisoning by Kafir corn (*Queensland Agr. Jour., 3 (1898), No. 4, p. 321*).—A note on this subject.

Powdered soap as a cause of death among swill-fed hogs, V. A. Moore (*New York Cornell Sta. Rpt. 1898, pp. 409–418*).—A reprint of Bulletin 141 of the station (E. S. R., 9, p. 1090).

Systematic feeding and watering as a preventative of diseases in horses, J. B. Paige (*Agr. Massachusetts, 1897, pp. 254–267*).—A general discussion of the subject.

AGRICULTURAL ENGINEERING.

One year's work done by a 16-foot geared windmill, F. H. KING (*Wisconsin Sta. Bul. 68, pp. 44, figs. 13*).—The work done by a 16-foot geared steel power mill as well as the total wind movement, hour by hour, for the year ending March 6, 1898, are recorded in this bulletin. The mill is placed on the tower of the agricultural physics laboratory of the station and—

"Stands on a steel tower with its axis 22 ft. above the deck, 82 ft. above the ground outside the building, and about 106 ft. above lake Mendota. . . . The building is on the north slope of a hill, near its summit. It was impracticable to arrange the pumps and other machinery in the laboratory in such a way as to transmit the power directly to the driving shaft and an offset had to be made. . . . [This was done by means of] 14-inch flanged pulleys carrying a 6 inch rubber belt. . . . At the bottom of the 1-inch driving shaft a foot gear transmits the power to a 1½-inch horizontal shaft from which the pumps and other machinery are driven. . . . It will be observed that this arrangement has necessitated two transfers of power besides that in the head of the mill itself."

The work of the mill was measured by pumping water from a reservoir having an area of 285 sq. ft. into a measuring tank holding 141.2 cu. ft.

"When the measuring tank was filled to the top of the siphon it was automatically emptied. By means of a float . . . arranged to work the pen on a chronograph, a record was secured of the number of times the tank was emptied each day and of the interval between each emptying. The mean height to which the water was lifted was, during March and April, 1897, 10.5 ft., but after that date the lift was increased to 12.85 ft."

The pumps used were (1) a reciprocating pump with a 14-inch piston and a 9-inch stroke; (2) a bucket pump having a capacity of 120 gal. per minute, and (3) two pumps of the centrifugal type. Nearly all the work, however, was done with either the first or the second or the two combined. By combining the pumps in various ways it was possible to secure more work than by any one pump alone, but it was impossible to secure the maximum amount of work the mill was able to do.

"It frequently happened when the mill was left with one pump that during the night the wind became strong enough to carry two, but it did not get them until the next morning. So, too, when in the evening the wind was strong enough to work the two pumps and it was left with them the wind would go down until the two could not be handled, when if but one had been left this could have been worked all right. . . .

"The total amount of water pumped during the 365 days was 24,433 tanks, each holding 141.2 cu. ft. This is at the mean rate of 2.789 tanks each and every hour of the day, or 393.8 cu. ft. per hour and 6.562 cu. ft. per minute. Expressed in another way, the water pumped during the year is sufficient to cover 79.1 acres 12 in. deep or a rate of 2.6 acre-inches per day for the full year. . . . The largest amount of water pumped during any single day in the year was 39,540.2 cu. ft., which is a rate of 27.04 cu. ft. per minute."

Calculating the work done to 10-day periods it was found that "the smallest amount of water lifted 10 ft. high in 10 days was enough to cover 9.87 acres 1 in. deep, and this occurred from July 28 to August 7,

at the time when water for irrigation is most needed. The largest amount pumped occurred during the 10 days from February 13 to 23, and was enough to cover 75.73 acres 1 in. deep."

"The mean amount of water pumped during the 100 days from May 29 to Sept. 6 was 24.549 acre-inches per 10 days, and as this is the season when the water is most needed in the United States it shows about what the capacity of such a plant is for irrigating purposes where the lift is 10 ft. With a lift of 20 ft. the capacity would be a little less than one-half of this amount. That is to say 10 in. of water can be given to 24.5 acres of ground during 100 days where the lift is 10 ft. and 12.25 acres where the lift is 20 ft.; and 20 in. of water could be given to one-half of these areas, respectively. There were, during the year, 5,239 hours when the velocity of the wind equaled or exceeded a mean of 9 miles per hour and there were 3,531 hours when the mean velocity did not reach 9 miles per hour, during which time there was no water pumped or but very little, because the wind was too light."

The mill worked on an average 14.32 hours per day during the whole year and 10.74 hours per day during the period from March 6 to September 1 (the irrigation season).

The horsepower of the mill was calculated from the amount of water pumped and determined by brake tests. The effective horsepower measured by the water lifted during the year (365 days of 24 hours each) was .1817. Figured on the basis of 14.32 hours per day, the effective horsepower was .3044.

"In the last trials [with brakes] the indicated horsepower was . . . 3.932 times the effective horsepower, and did this ratio hold true for all of the pumping the actual horsepower developed by the windmill would be $.3044 \times 3.932 = 1.197$ horsepower, while the curve of brake tests gave 2.107 horsepower."

Under similar conditions a 2½-horsepower gas engine lifted 2.35 times the water pumped by the mill. The indicated horsepower of the engine in these trials was 1.8, the effective horsepower 1.02.

"During a 6-hours' run with this engine there were lifted to a height of 12.85 ft. 13,202.2 cu. ft. of water, with a consumption of 458 cu. ft. of gas, costing $1.25 per thousand. This is a cost for fuel of 95.4 cts. per day of 10 hours' work."

From tests of the mill in grinding corn when the wind velocity was from 9 to 30 miles per hour, it is calculated that—

"the total amount of feed which could be ground by the mill in a year was 871,500 lbs. or 15,560 bu. of 56 lbs. Grinding trials were also made with a Webster 2½-horsepower gas engine, and its rate was found to be 6,408 lbs. per day of 10 hours with a cost of fuel of 99 cts. The windmill was therefore able to do during the year the equivalent of 136 days of the 2.5-horsepower engine."

It was found that the loss of energy in the offset pulleys was .18 horsepower, and in the entire system of shafting, including the offset pulleys, .767 horsepower, when the shaft was making 500 revolutions per minute.

The sanitation of farm buildings, J. SCOTT (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 9 (1897), pp. 40–60, figs. 7*).—The topics discussed are sanitary legislation, requirements for health, site and foundations, ventilation, lighting, drainage, conservancy, water supply, lambing folds, and disinfectants.

Lecture and articles on irrigation in India, America, Egypt, and Australia, R. WALLACE (*Edinburgh: Oliver & Boyd, 1898, pp. 31*).—Brief popular essays.

Unprofitable irrigation works, T. S. VAN DYKE (*Irrig. Age, 13 (1898), No. 2, pp. 45–50*).

Irrigation in Wyoming, J. SHOMAKER (*Irrig. Age, 13 (1898), No. 2, pp. 41–44*).

Irrigation of fields and lawns, R. V. (*Belg. Hort. et Agr., 10 (1898), No. 15, pp. 234–236, figs. 4; 16, pp. 253–255, figs. 3; 17, pp. 269, 270, figs. 5*).—A popular article describing a variety of methods and apparatus.

Mountain water courses as industrial aids (*U. S. Consular Rpts., 58 (1898), No. 219, p. 618*).—An abstract of a discussion of the desirability of building reservoirs to store storm waters in Germany.

Wide tires on farm wagons, J. M. STAHL (*Country Gent., 63 (1898), No. 2382, pp. 744, 745*).

Cow barn with framework of steel (*Irrig. Age, 13 (1898), No. 2, pp. 64–68, figs. 6*).

The experimental elevator at Berlin (*Deut. Landw. Presse, 25 (1898), No. 88, pp. 931, 932, figs. 2, plan 1*).—A description and the plan of the building are given and its purpose pointed out. Experiments in storing and handling grain under different conditions are to be conducted.

STATISTICS—MISCELLANEOUS.

Crop circular for October, 1898, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circ., Oct., pp. 8*).—This circular contains notes on the condition of the principal crops with estimates of the yields and a synopsis of the weather conditions east of the Rocky Mountains for September, 1898. The English, French, and Hungarian estimates of the world's wheat crops by countries for 1897–98; the rainfall percentages east of the Rocky Mountains from April to September, and the average yield per acre and average condition of crops by States and Territories October 1, 1898, are given in tables.

Crop circular for November, 1898, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circ., Nov., pp. 4*).—Preliminary estimates on the crops of 1898, and on the wheat crop of a number of foreign countries are given.

Report on crops, live stock, etc., in Manitoba (*Ontario Dept. Agr. and Immigr. Bul. 56, pp. 25*).—This bulletin is a summary of the conditions of the crops and live stock, estimates of the yield of various crops, and the quantities of land broken during the season. General notes on the agricultural conditions of the several districts are given.

Twelfth Annual Report of Alabama Canebrake Station, 1897 (*Alabama Canebrake Sta. Rpt. 1897, pp. 15*).—Contains a financial statement for the civil year ending December 31, 1897, and a report on station work, noted elsewhere.

Tenth Annual Report of Connecticut Storrs Station, 1897 (*Connecticut Storrs Sta. Rpt. 1897, pp. 276*).—This includes general remarks on the work of the station during the year; a financial report for the fiscal year ending June 30, 1897; various articles on foods and animal production, abstracted elsewhere; and an index to annual reports 1 to 10, inclusive.

Report of Massachusetts Hatch Station, 1897 (*Massachusetts Hatch Sta. Rpt. 1897, pp. 138*).—This contains a brief summary of station work and a financial statement for the fiscal year ending June 30, 1897, and reports of the various departments, noted elsewhere.

Eleventh Annual Report of New York Cornell Station, 1898 (*New York Cornell Sta. Rpt. 1898, pp. XIX; Append. I, pp. 337–721; II, pp. XI; III, pp. 69–125*).—This contains reports by the director, treasurer, chemist, botanist, entomologist, agriculturist, horticulturist, veterinarian, and the assistant professor of dairy husbandry and animal industry for the year ending June 30, 1898. Appendix I is made up of reprints of Bulletins 138–149 of the station. Appendix II gives a detailed state-

ment of receipts and expenditures of the station for the fiscal year ending June 30, 1898. Appendix III consists of reprints of Teacher's Leaflets on Nature Study 8-11.

Reports of North Carolina Station for 1897 and 1898 (half year) (*North Carolina Sta. Rpt. 1897 and 1898, pp. XLIV+423-426*).—This contains reports of the director and heads of departments covering the work of the station from January 1, 1897, to June 30, 1898, and financial statements for the fiscal years ending June 30, 1897 and 1898.

The North Carolina Agricultural Experiment Station, W. A. WITHERS (*North Carolina Sta. Spec. Bul. 48, pp. 11*).—Notes on the station staff and the equipment and work of the station.

The station and its exhibit (*North Carolina Sta. Spec. Bul. 50, pp. 16*).—A special bulletin explanatory of the station and its exhibit at the annual fair of the North Carolina Agricultural Society in 1898.

Experiment Station Work, VII (*U. S. Dept. Agr., Farmers' Bul. 84, pp. 32, figs. 8*).—This includes the following popular articles: Home-mixed fertilizers, forcing asparagus in the field, field selection of seed, potatoes as food for man, corn stover as a feeding stuff, feeding value of sugar beets, salt-marsh hay, forage crops for pigs, ground grain for chicks, skim milk for young chickens, by-products of the dairy, stripper butter, curd test in cheese making, and gape disease of chickens.

The development of agriculture in Japan (*L'Engrais, 13 (1898), No 47, pp. 1117, 1118*).

Fourth report of progress on extension work, I. P. ROBERTS (*New York Cornell Sta. Rpt. 1898, pp. 633-654, maps 3*).—A reprint of Bulletin 146 of the station (E. S. R., 10, p. 498).

NOTES.

Arizona Station.—A new office building, costing $310, has been erected at the substation at Phoenix. Attention is being given to the introduction of plants not indigenous to that section, the testing of new varieties of fruits, and especially the date palm, which promises success. The growing and fattening of live stock has been taken up. The result of sugar-beet experiments indicates that beets of high quality may be grown far south of the usually accepted region for first-class beets. Inoculation experiments have been made with the crown knot of fruit trees, showing its ability to spread by this means.

Montana College and Station.—E. V. Wilcox has resigned his position as zoologist and entomologist in the college and station, to take effect April 1, 1899, and has accepted a position in the Office of Experiment Stations of this Department, *vice* F. C. Kenyon, resigned. Dr. Wilcox will have charge of the departments of zoology, entomology, and veterinary science of the Experiment Station Record. John M. Robinson and Walter S. Hartman, both of Bozeman, have been appointed on the executive board, *vice* Nelson Story and Walter Cooper, whose terms have expired.

New Mexico College and Station.—C. A. Keffer, of the Division of Forestry of this Department, has been appointed agriculturist and horticulturist in the college and station. He will enter upon his new duties in the early spring.

Pennsylvania College and Station.—G. E. Voorhees, formerly superintendent of the National Farm School of Doylestown, Pennsylvania, has been employed as temporary instructor in agricultural chemistry during the absence of Prof. William Frear at the farmers' institutes. Much interest is being manifested at various farmers' institutes in the work of the station and school of agriculture, and numerous applications for reports and bulletins are constantly being received.

South Carolina Station.—The board of trustees at a recent meeting ordered the college farm divorced from the experiment station. A short bulletin has just been prepared for the purpose of encouraging cooperative experimental work among the farmers, especially among the auxiliary experiment clubs organized under the auspices of the farmers' institutes last summer.

Miscellaneous.—Memorial services for the late Senator Justin S. Morrill were held in both branches of Congress February 22. Several addresses were delivered, which, together with the report of the funeral services held in the Senate Chamber and at Montpelier, Vt., are published in the Congressional Record for that date. The executive committee of the Association of American Agricultural Colleges and Experiment Stations, at a recent meeting held in Washington, voted to recommend that all land-grant colleges observe April 14, next, Senator Morrill's birthday, with appropriate services in his honor. They also voted to invite President Buckham, of the University of Vermont, to prepare a set of resolutions to be presented at the next convention of the association, and President Atherton, of Pennsylvania State College, to present an address on Senator Morrill's life work in the interests of the education of the industrial classes.

Dr. C. G. Gibelli, professor of botany and director of the Botanic Institute of the University of Turin, died September 16, 1898.

Dr. van Tieghem, the well-known botanist, has been elected president of the Paris Academy of Sciences.

Dr. W. Schimpfer, of Bonn, has accepted a call to Basel as professor and director of the botanical garden.

Dr. F. W. C. Areschoug, professor of botany of the University of Lund, has retired and Prof. S. Berggren has been chosen as his successor.

Dr. A. Zschokke has been chosen director of the recently established Wine and Fruit Culture School at Neustadt, Bavaria.

Dr. Adolph Osterwalder has become assistant in the laboratory of plant physiology of the Experiment Station and School for Fruit, Wine, and Garden Culture in Wädensweil, Switzerland.

Dr. Roux, of the Pasteur Institute, has been elected a member of the agricultural section of the Paris Academy of Sciences, taking the place left vacant at the death of Aimé Girard.

At a recent meeting held in London to consider questions connected with Cambridge University it was stated that the Drapers' Company would subscribe $4,000 a year for ten years in support of a professor of agriculture. Sir Walter Gilby has subscribed $1,000 a year for the same period to provide for a readership of agriculture.

The commission which was appointed sometime ago in France to consider the question of colonial botanical gardens and agricultural experiment stations has recommended that a station be established in each of the French colonies and a central station for the distribution of seeds and plants. A decree has been issued organizing such a station at Vincennes, and J. Dybowski has been appointed director.

Notice has been received that the International Veterinary Congress will be held at Baden, Germany, August 4-14, 1899. The subjects to be discussed include prophylactic measures to prevent the spread of cattle diseases by the export of animals, treatment of tuberculosis in domestic animals, use of flesh and milk of animals affected by tuberculosis, and requirements for inspection of meat, cure of foot and mouth disease and diseases of swine, dissemination of veterinary instruction, preparation of a uniform anatomical nomenclature in veterinary medicine, and cure of rabies.

The new bacteriological institute of the University of Louvain, of which Professor Denys is the head, was formally opened in February. A special department of the institute will be devoted to the preparation of therapeutic serums, etc.

The December number of the *Forstlich-naturwissenschaftliche Zeitschrift* announces the discontinuation of that journal owing to the removal of the editor, Dr. Carl Freiherr von Tubeuf, from Munich to Berlin, as previously noted (E. S. R., 10, p. 400).

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director.*

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers, and Soils (including methods of analysis), and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
——— ———.—Entomology and Veterinary Science.
R. A. EMERSON—Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 8.

To the list of agricultural experiment stations in this country must now be added that of Alaska, which has been organized under the supervision of this Department. For the past two years the agricultural conditions and possibilities of that country have been inquired into with a view to determining what encouragement there might be for undertaking experiment station work. The first year Congress appropriated $5,000 for this inquiry, and the result was so encouraging that last year the appropriation was increased to $10,000. Prof. C. C. Georgeson, until recently connected with the Kansas Agricultural College and Experiment Station as agriculturist, was placed in charge of the work. The Weather Bureau of this Department cooperated in the enterprise by establishing a special meteorological service for Alaska. Headquarters were established at Sitka, a small building being rented for office purposes. Several small patches of cleared land at Sitka, including the garden of the Governor of the Territory, were secured, and on these were planted seeds of a large number of cereals, forage plants, and vegetables, specially selected for the purpose. More restricted experiments in growing cereals and vegetables were made at Skagway by a settler in that place who was formerly connected with the Kansas Agricultural College.

The results at Sitka brought out some interesting facts regarding the soil and the suitability of the climate for growing food crops. It was demonstrated that oats and barley will not only make an excellent growth, but will mature in southeastern Alaska. This has not been determined for wheat and rye, but experiments with fall-seeded grain are now in progress. The Riga flax grew excellently, and gave promise that a good commercial article can be produced, suggesting a possible industry for the natives. Several kinds of clovers "grew with remarkable vigor," the plants from the American seed making the best growth. Buckwheat made a good growth and bloomed abundantly, but was killed by frost before it was ripe, owing to late planting. Among the vegetables, asparagus, beets, carrots, cress, kale, kohl-rabi, lettuce, onions, parsnips, peas, potatoes, radishes, ruta-bagas, rhubarb, salsify, turnips, and Windsor beans all did well on old ground, and showed that the climate and soil were favorable to their growth. Cabbage and cauliflower suffered from club root, but the plants which escaped indicated that these vegetables can be grown with proper treatment.

At Skagway the land was newly cleared and was "raw and sour, containing a large percentage of imperfectly decayed vegetable matter, mostly the rotten wood of conifers which had accumulated in the course of ages." But in spite of these unfavorable conditions and the fact that planting was delayed until June, oats, barley, and flax were successfully grown, together with a long list of vegetables.

One important fact developed during the past season is the sensitiveness of certain varieties and crops to the new ground, and its possible explanation of the adverse criticisms which have been made on Alaska as a farming country. The newly broken ground is raw, sour, and water-logged, and contains a large amount of decaying wood, etc. It needs to be aerated, drained, and in many cases limed to make it suitable for most cultivated plants. For example, barley and flax were nearly total failures on new ground and oats were only a partial success, while on old ground they all made excellent growth. The same was true of varieties of clover from Norway, and a considerable number of vegetables. The seed in all cases germinated promptly in the new ground, but the young plants languished, turned yellow, and soon died. The failure in all these cases was due to the soil and not to the climate.

In addition to these field trials, observations and records were made of soil temperatures, and samples of soil were taken for moisture and other determinations. A number of places in the coast region of Alaska were visited, and surveys and reservations of land for experimental purposes were made at Sitka, Kadiak Island, and Kenai in Cook Inlet. Considerable additional information relative to the agricultural conditions in different parts of Alaska was obtained in response to circulars of inquiry.

Dr. Walter H. Evans, of this Office, continued his botanical survey during the past summer, adding a considerable number of new specimens of the flora of the coast region. Several species were found which give promise of considerable value as sand binders. The reports of Professor Georgeson and Dr. Evans for the past year have recently been issued.

On the whole, the outcome of the two years' investigation was sufficiently encouraging to recommend the establishment of a station or stations on a definite basis, and Congress has accordingly increased the appropriation for the ensuing year.

The main station will be located at Sitka, and an office and laboratory building costing about $5,000 will be erected there this spring on a small tract of land reserved for that purpose. Other land near Sitka will be cleared and broken and put in shape for field trials. This will be of little use the coming season except for growing forage for the work animals, but several small patches of old ground have been secured for continuing the field tests.

At Kenai a tract of land will be cleared and broken, and log silos will be erected for ensiling the native grass, which is abundant and nutritious, but not easily made into hay on account of the very frequent

rains and high humidity. Hardly more than a beginning can be made at that place during this season. Arrangements have been made with a resident of Kadiak to begin experiments on old ground at that place; and cooperative trials will be made at various other places, so that a quite extensive area of country will be included in the work this year.

The headquarters of the Weather Bureau will be moved into the interior, but it will continue to cooperate with the Alaska station, and will make observations on soil temperatures at different places.

Professor Georgeson will remain in charge of the work, and will reach Alaska about the middle of April. He will take with him Mr. C. H. Robison, a graduate of the Michigan Agricultural College in 1895, as assistant at Sitka, and Mr. H. P. Nielsen, formerly of the Kansas Agricultural College, as assistant at Kenai for the summer. He has also engaged three laborers to go to Alaska for the summer, as there is difficulty in procuring satisfactory farm laborers there. Several yoke of oxen will be shipped there from Oregon, and a full line of implements, including wagons, stump pullers, plows, cultivators, harrows, hand tools, etc., will be taken.

The new station will not be on the same basis as the stations receiving the Hatch fund. It will be maintained by funds appropriated for the Secretary of Agriculture and not subject to the provisions of the Hatch Act. It will be conducted under the supervision of this Office, as the Alaska investigations of the past two years have been, and reports of its operations will be made to Congress annually. Moreover, its problems will be different from those presented to stations in States where agriculture is already a reality. There can not be said to be any agriculture in that vast tract of country at present. Aside from the products of small gardens and the fishing industry, the country is almost entirely dependent for its food supplies on materials shipped there. An important function of the station will be to prepare the way for agriculture and to aid in its development. It will be necessary to demonstrate the capabilities of different sections of the country, determine the best methods of managing the soil, procure varieties of plants suited to the climate and the season, devise methods for preserving forage crops, etc.

Much interest in the establishment of a station has developed among people who have gone to Alaska during the past few years. It has become apparent to them that if the mineral wealth of the Territory is to be developed, sufficient agriculture should be developed, if possible, to furnish at least a part of the food products required by the increasing population, thus reducing the cost and furnishing a greater diversity of industries. If it can be shown that it is possible for a man to live there on the product of the land, without being entirely dependent on the mines, a strong factor will have been gained for the development of the country. If the home markets can be supplied with the principal food products, the independence of this isolated country will be materially increased and it will become a far more attractive place in which to live.

TWELFTH ANNUAL CONVENTION OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

W. H. Beal,

Office of Experiment Stations.

The twelfth annual convention of the Association of American Agricultural Colleges and Experiment Stations was held at Washington, D. C., November 15–17, 1898. All sections of the country were represented, there being 154 delegates and visitors in attendance. Arizona, Kansas, Oregon, and Texas were the only States which did not send delegates.

GENERAL SESSIONS.

The convention was called to order and presided over by the president of the Association, H. C. White.

A report of the executive committee, briefly reviewing the work of that committee during the past year, was submitted by the chairman, H. H. Goodell.

The usual section reports were submitted by the chairmen of sections, as follows: College work, Alston Ellis; agriculture and chemistry, R. J. Redding; horticulture and botany, S. T. Maynard; and entomology, J. B. Smith. No report was received from the section on mechanic arts.

The address of the president, H. C. White, was a scholarly presentation of the purposes and potentialities of the Association, showing the breadth and strength of the scientific and industrial education offered by the land-grant colleges, and pointing out how such institutions may be made to produce the "scholar" just as truly as schools built on classical foundations.

"The industries whose fruits satisfy the material needs of man which, if you please, accumulate his wealth, which regulate his commerce and direct his trade, are no longer exclusively or best served by the unremitting muscular energy of toiling millions, nor yet by high efficiency of manual skill. They have come to involve in their prosecution intellectual abilities of the highest order and become not only thereby fit occupation in activity for him who is to be the scholar but, indeed, unremunerative and unadapted to those lacking some part of scholarly training. . . . The intellectual training which shall best serve the application of intellectual power to industrial pursuits is not yet systematized, has not yet been given a satisfactory form to serve for pedagogic purposes. To give it such form, to fit it to the needs and the uses of the great masses of those who, in the nature of things,

may not have other scholarly attributes than that of action and at the same time suit it to the equipment of the scholar who shall be differentiated from the masses is one high and important office of the American university which is to be."

He pointed out that the land-grant colleges which derive their support so largely from the United States Treasury together constitute this great national university.

On motion of G. W. Atherton, the president's address was referred to a committee of five for consideration. This committee, which consisted of G. W. Atherton, J. E. Stubbs, R. H. Jesse, E. A. Bryan, and J. K. Patterson, subsequently reported as follows:

"(1) That the proceeds of the United States land-grant act of 1862 and the annual appropriations provided for by the acts of Congress of 1887 and 1890 are a national trust to be administered by the several States in strict accordance with the letter and the spirit of the grant.

"(2) That the land-grant colleges whether organized separately or as branches of State universities are primarily educational institutions required by law to teach certain branches of learning.

"(3) That these branches of learning are to be taught with special reference to their 'applications in the industries of life.'

"(4) That this requirement involves a thorough fundamental training in the principles of the mathematical, physical, and natural sciences, in order that their practical applications may be clearly understood, and forbids that the institutions shall in any way be regarded as 'trade schools.'

"(5) That the land-grant colleges are required by law to provide a 'liberal' as well as a 'practical' education, and that it is therefore their special duty to study, practice, and develop sound principles of instruction in the teaching of all branches of learning both liberal and technical, to the end that the subjects taught may be made the means and instruments of a true education, as well as a means of acquiring a body of concrete knowledge.

"(6) That the aim of all research should be to learn the truth, and the aim of all teaching to teach the truth and nothing but the truth; and that to this end freedom of research and freedom of teaching are indispensable.

"(7) That all teaching should accordingly be absolutely free from partisan or sectarian bias; that the institutions should be free from partisan or sectarian control, and that no interference in the administration or in the teaching or in the tenure of office should be allowed on partisan or sectarian grounds."

The Secretary of Agriculture responded to an invitation to address the convention. He referred to his efforts to bring the Department of Agriculture into closer sympathy with the agricultural colleges and experiment stations, and briefly discussed the character and extent of the work done by the Department in the interest of agriculture. He urged upon the agricultural colleges the importance of special effort to make their courses attractive to farmers' sons and especially adapted to their needs. He suggested as means to this end the introduction of nature studies into the common schools, and the more thorough training of teachers for such schools in the natural sciences.

A resolution, introduced by R. H. Jesse, favoring the introduction into the public and grammar schools of nature study and instruction in the elements of the economic sciences, and the training of teachers in these various lines at the agricultural colleges, was adopted.

A report of the committee on graduate study at Washington,[1] submitted through G. E. MacLean, introduced a discussion of one of the most important topics taken up by the convention. The report gave a detailed account of the operations of the committee during the past year, with the conclusions that—

"It is entirely practicable to provide for the use of the Library of Congress and the collections of the Smithsonian Institution, the National Museum, and of the various scientific and other bureaus in the several departments of the General Government, by graduate students of the land-grant and other colleges for study and research, and that it is also practicable to organize, coordinate, and direct such work so as to make it eminently effective. . . .

"It submits tentatively that Congress might be asked to provide for the establishment of an administrative office in Washington, preferably in the Smithsonian Institution, in which graduate students of the institutions we represent, and others as well, might be enrolled and directed to the appropriate departments.

"To maintain this office, pay the expenses of administration, support graduate courses of research, freely open to the graduate students of the land-grant and other colleges without distinction of race, sex, or color, on such terms as the administrative office should prescribe, and to aid such students in their researches, Congress might be asked to make an appropriation of, say, $25,000, to be increased annually $1,000, to be expended under the discretion of the institution or department in which the office of administration may be located."

The discussion of this subject was participated in, upon invitation of the chairman, by Mrs. Calvin S. Brice and ex-Governor J. W. Hoyt, who spoke of their interest in the subject and of the efforts of the George Washington Memorial Association to establish a National University in Washington.

The report was approved and adopted. The committee was continued and empowered, in connection with the executive committee, to propose and secure if practicable such legislation as will carry out the object and purposes of the resolution under which it was appointed. The committee consists of C. Northrop (chairman), Alston Ellis, M. H. Buckham, G. E. MacLean, Alexis Cope, and J. H. Washburn.

Another subject which provoked lively discussion was the detail of military officers to the agricultural colleges. Much dissatisfaction was expressed with the present condition of affairs in this respect. The matter was finally "referred to the executive committee with power."

A paper on Land-grant and other colleges and the national defense[2] was read by C. W. Dabney. In this paper it was urged that the Government take steps to recognize these institutions more fully as agencies for the training of the officers who will be needed for our increased military establishment. A considerable number of the graduates of these institutions served with distinction in the war just closed, and there is good reason to believe that in the reorganization of our volunteer army it will be necessary to look to these institutions very largely for the trained material needed to put the volunteer army on a more efficient basis.

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[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 49, p. 39.

[2] This paper has been published as Circular 40 of the Office of Experiment Stations.

On motion of A. W. Harris, a committee of seven, consisting of G. W. Atherton (chairman), A. W. Harris, C. W. Dabney, A. Cope, H. H. Goodell, R. H. Jesse, and H. C. White, was appointed "to consider the organization and extent of military work which can be properly undertaken by the land-grant colleges and the proper relation of this work to the military service of the several States and of the United States; that this committee, in conjunction with the executive committee of the Association, be empowered to propose and secure if practicable such legislation as may be necessary to carry out the conclusions which the committee may reach."

One of the important reports submitted was that of the committee on the collective station exhibit at the Paris Exposition. This report gave the general features of a plan which the committee has formulated for this exhibit, which is to be similar to that at the World's Fair at Chicago. The recommendation of the committee that the exhibit when prepared should be a permanent one and that the Secretary of Agriculture be requested to provide a proper place for it after its return from Paris, was adopted by the Association. The committee was continued and instructed to prepare the exhibit. This committee is made up as follows: H. P. Armsby (chairman), W. H. Jordan, A. W. Harris, M. A. Scovell, and A. C. True.

As was expected, the question of amendment to the constitution, brought over from the previous convention,[1] received very full consideration and discussion. The discussion developed a very strong opposition to confining the work of the Association to purely administrative matters. The majority report recommending the abolition of all sections was rejected, while the minority report providing for 3 sections, (1) administrative, (2) agriculture, and (3) horticulture, was laid on the table.

The committee on engineering experiment stations submitted a brief report of progress, and recommended that the bill which has been drawn up to be laid before Congress be so amended as to permit investigation in marine engineering, naval architecture, and the theory and use of projectiles on land and sea. The committee, consisting of C. S. Murkland (chairman), F. P. Anderson, M. H. Buckham, A. W. Harris, and J. E. Stubbs, was continued, and directed to cooperate with the executive committee in urging this legislation upon Congress.

The report of the bibliographer, A. C. True, outlined the bibliographical work of the Department of Agriculture during the year, and gave a list of 10 or more bibliographies of interest to agriculture which have recently appeared.

The committee on indexing agricultural literature submitted through the chairman, A. C. True, a report embodying a scheme of classification of agricultural literature prepared by W. P. Cutter, Librarian of the Department of Agriculture. "This classification is designed to cover agriculture only, and not such subjects as farm architecture, systematic

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[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 49, p. 28.

entomology and botany, or farm engineering. The scheme is designed to be used with the Dewey system of classification."

A. C. True submitted the third report of the committee on methods of teaching agriculture.[1] This gives a syllabus for a course of instruction in agronomy (plant production). After some discussion, it was voted that the reports of this committee be made the subject of special consideration at the next annual convention.

A paper by O. L. Waller entitled What shall be the character of the preparatory work required to enter four-year engineering degree courses? was reported from the section on mechanic arts and read in general session.

A paper from the section on agriculture and chemistry entitled Some notes in connection with the testing of cows as to milk and butter production by M. A. Scovell was read in general session.

T. E. Miller, president of the Colored Normal, Industrial, Agricultural, and Mechanical College of South Carolina, read a paper on The undeveloped agricultural resources of South Carolina.

The subject of mailing lists for experiment stations was discussed, and a resolution was adopted urging upon all stations the use of the mailing lists prepared by the Office of Experiment Stations.

C. C. Georgeson and A. C. True spoke briefly of the progress made in investigating the agricultural possibilities of Alaska, a number of products grown there during the season of 1898 being exhibited.

During the course of the convention the Association as a body paid its respects to the President of the United States.

Invitations were extended to the Association to hold its next convention in California, Washington, and New York. The matter was referred to the executive committee.

Officers were elected for the ensuing year as follows:

President, H. P. Armsby, of Pennsylvania; vice-presidents, J. E. Stubbs of Nevada, C. S. Murkland of New Hampshire, J. L. Snyder of Michigan, P. H. Mell of Alabama, and F. P. Anderson of Kentucky; secretary and treasurer, E. B. Voorhees, of New Jersey; executive committee, H. H. Goodell of Massachusetts (chairman), A. Cope of Ohio, J. H. Washburn of Rhode Island, W. M. Liggett of Minnesota, and *ex officio* the president, the junior ex-president (H. C. White), and the secretary and treasurer; bibliographer, A. C. True, of Washington, D. C.

Section on college work.—Chairman, C. W. Dabney, of Tennessee; secretary, C. E. Coates, of Louisiana.

Section on agriculture and chemistry.—Chairman, J. L. Hills, of Vermont; vice-chairman, C. E. Thorne, of Ohio; secretary, E. Davenport, of Illinois.

Section on horticulture and botany.—Chairman, L. H. Pammel, of Iowa; secretary, S. B. Green, of Minnesota.

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[1] U. S. Dept. Agr., Office of Experiment Stations Circ. 39.

Section on entomology.—Chairman, C. W. Woodworth, of California; secretary, L. Bruner, of Nebraska.

Section on mechanic arts.—Chairman, C. S. Murkland, of New Hampshire; vice-chairman, G. A. Harter, of Delaware; secretary, F. P. Anderson, of Kentucky.

MEETINGS OF SECTIONS.

SECTION ON COLLEGE WORK.

The sessions of the section on college work were devoted to papers and discussions on recent changes in the theory of higher education and the relation of the churches to State colleges and universities.

Discussion of the first subject was introduced by a paper presented by E. A. Bryan, who traced the progress of several American colleges in their attempts to improve their curricula by giving to the natural and physical sciences an equal place with linguistic and philosophic subjects. The nature of education will be determined by the use to which it is to be put, and the modern idea that the purposes of higher education include the application of its results to industry and the material welfare of mankind has done much to revolutionize the college methods. The separation of culture and utilitarian ends was considered impossible.

R. W. Silvester spoke of the impulse given by President Eliot to higher education by the introduction of the elective system into the undergraduate courses. The evolution of the individual and the changed attitude of instructor to student were dwelt upon. The Association was urged to aid in the establishment of a national university in Washington characterized by the truly scientific spirit.

J. E. Stubbs gave an historical retrospect of national civilizations by which education in its modern aspect is to be interpreted. He said the end of education should be the development of cultured manhood which fits for a passport to high position in every sphere of usefulness.

A. W. Harris read a paper on The relation of the church to State colleges and universities, in which he urged the obligation of the churches to extend their care to students in undenominational as well as denominational institutions, and suggested the establishment by the different denominations of dormitories and chapels for the students of their membership. It was also suggested that the churches might furnish funds to provide the State colleges and universities with preachers and lecturers that theological courses might be maintained.

In the discussion which followed, J. L. Snyder expressed the opinion that the churches did not have the means to carry out the plans suggested by Dr. Harris in addition to keeping up denominational schools. The most effective way for the churches to hold their young people was to place in the pulpits of the university towns and cities the stronger preachers in their denomination. The faculty should encourage the students to activity in the churches in the immediate vicinity.

M. H. Buckham, J. H. Canfield, and W. I. Chamberlain agreed with the previous speaker that religious instruction might be safely left to the church and the home. The subject was further discussed by A. B. Peebles and J. E. Stubbs, the latter holding that the State colleges in the far West in nonchurch going localities needed the influence of the church, and that the different denominations should plant church organizations and auxiliary colleges in the vicinity of such institutions and enable the students to have direct religious culture under the direction of their own church.

SECTION ON AGRICULTURE AND CHEMISTRY.

In the section on agriculture and chemistry the first paper was submitted by W. I. Chamberlain. The subject of this paper was Recent investigations, together with former experiments, on the relation both of commercial fertilizers and of clover to wheat growing in Ohio.[1] In it the author quotes statistics which he believes tend to show that there has been a relative decline in clover growing and an increase in the acreage and yield of wheat in Ohio. This increased production of wheat he believes to be due largely to a more liberal use of commercial fertilizers. The direct purchase of unmixed fertilizing materials for cash at wholesale is considered impracticable as a rule, although sound in theory. He stated that in his opinion the attitude of some of the experiment stations has seemed to be antagonistic to fertilizers, and that he deplored this state of affairs.

This paper provoked a lively discussion of the relation of the experiment stations to the fertilizer business. W. Frear maintained that in those States where the purchase of fertilizers is an important factor in farm expenditures the stations should aid the farmer in the intelligent purchase and application of fertilizers. He believed this to be the attitude assumed by most of the experiment stations, and that the position needed no defense. W. H. Jordan stated that while he recognized that there are manufacturers and agents who stand on as sound and dignified a basis in what they say and do as any other class of men, he was personally cognizant of methods and arguments in vogue which made it incumbent upon the experiment stations of his State to secure better methods of trade than those now prevailing; and he believed the New York Station or any station in the Eastern States—he could not speak as to the West—could do for the farmers no better service than to point out to them more efficient and economic methods of purchasing plant food. The attitude of the stations had been not so much directly antagonistic to the purchase of commercial fertilizers, as an attempt to point out to the farmers of the Eastern States the value of their home resources. He wished to disclaim on the part of eastern experiment stations, as far as he had any authority to speak for them, any such position as antagonism to the judicious and economical use of commercial fertilizers.

[1] This paper has been published in a series of articles in the Ohio Farmer.

I. P. Roberts read a paper on Productivity as affected by tillage, in which he showed that by the employment of better methods of tillage the soil supplies of fertility may be more largely utilized, and thus the necessity for applications of fertilizers may be greatly reduced.

H. P. Armsby read a preliminary account of feeding experiments at the Pennsylvania Station which are reported in detail elsewhere.[1]

The report of the committee on uniform fertilizer legislation was submitted by H. J. Wheeler, and adopted as submitted. The recommendations of the committee will be found elsewhere (E. S. R., 10, p. 506). The only portion of this report which called out any discussion was that relating to the form of guarantee of phosphoric acid, but the recommendation of the committee on this point was finally adopted.

H. J. Wheeler read a paper on The possibility of drawing erroneous conclusions from plant-soil tests. In this paper, which was based upon the results of experiments at the Rhode Island Station, attention was called to the unreliability of soil tests with fertilizers under certain conditions, e. g., with a deficiency of lime or of available phosphoric acid. Attention was called to the fact that the value of lime as a liberator of inert phosphoric acid may be, in certain soils, of more far-reaching importance than is generally supposed.

This paper gave rise to considerable discussion, in which the danger of drawing hasty conclusions from experiments with fertilizers was strongly emphasized.

A paper on The significance of stock-feeding experiments was read by C. F. Curtiss. This paper discusses the progress made in applying scientific principles to practical stock feeding in the United States, and points out the practical value of feeding experiments by the stations in showing the feeder how to raise a better product at a less cost and how to get the greatest return for the feed consumed under varying conditions. In many cases, however, work of this character has been superficial. It should be made more thorough and confined to a few definite lines.

The report on nomenclature was submitted by H. P. Armsby. Two questions are considered in this report: (1) The terms "concentrates" and "roughage" as applied to feeding stuffs by Henry, and (2) the nomenclature of nitrogenous compounds. As regards the first, the committee was of the opinion that action by the Association was unnecessary. As regards the second, the committee recommended "for present use certain collective terms," as follows:

- PROTEIN
  - Proteids
    1. Albuminoids (albumins, globulins, coagulated and compound proteids, and other cleavage products down to and including peptones).
    2. Collagens or gelatinoids (collagen, elastin, and related nitrogenous bodies specially characteristic of connective tissue).
  - Nonproteids (a general term for noncoagulable nitrogenous matter, including nitrogenous extractives in the animal, and amids and similar bodies in the plant).

[1] Pennsylvania Sta. Bul. 42.

A paper on The nomenclature of nitrogenous compounds of animal and vegetable substances was presented by W. O. Atwater.

The paper by M. A. Scovell, previously referred to (p. 708), was very fully discussed in a session of the section.

J. S. Newman read a paper on The relation of the land-grant colleges to the experiment stations viewed from the standpoint of the agriculturist.

SECTION ON HORTICULTURE AND BOTANY.

In this section B. D. Halsted discussed the relations of climate and rainfall to prevalence of fungus diseases, displaying a chart showing the monthly rainfall, April to September, for ten years (1889–1898), and pointing out the coincidence between seasons of heavy rainfall and severe outbreaks of fungus diseases.

L. C. Corbett read a paper on Laboratory methods in teaching horticulture, in which the advantages of such methods were pointed out.

The committee on cooperative tests of different races of peaches submitted a progress report, giving an account of the organization of cooperative work in this line with 24 experiment stations in 4 belts running north and south across the United States—2 east of the Mississippi River and 2 west of that river. Tests are to be made of 3 varieties of each of 5 races of peaches[1]—Peen-to, South China, Spanish, North China, and Persian.

S. M. Emery discussed the subject of fruit testing by experiment stations.

J. Craig presented the rules for pomological nomenclature adopted by the Horticultural Lazy Club of Cornell University.[2] After a full discussion of the subject it was voted that a permanent committee of five, to be known as a committee on nomenclature, be appointed to have charge of matters pertaining to horticultural nomenclature. The committee appointed is F. A. Waugh, J. Craig, W. A. Taylor, L. R. Taft, and G. H. Powell.

A joint session of this section and of the section on entomology was held to consider the subject of inspection of nursery stock and trees. The discussion of this subject was opened by a paper by W. E. Britton on Nursery inspection in Connecticut. This paper reviewed the work accomplished under the peach yellows law enacted in 1893 and repealed in 1897. While the work of the peach yellows commission appointed under this law was very effective, there is little immediate prospect of securing the enactment of other laws of this character in Connecticut. The Connecticut State Experiment Station has, however, undertaken inspection work on its own responsibility, and in many cases at the request of the nurserymen themselves, who find it desirable to have certificates of inspection. A number of examples are cited to

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[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 49, p. 82.

[2] Amer. Gard., 19 (1898), p. 712.

show the difficulties encountered in such work. The San José scale has been found to be quite widely disseminated in the State. As a rule left-over stock is more likely to be infested than the newer stock. Uniform laws and systems of inspection are much to be desired.

In discussing this subject J. B. Smith said that he considered the inspection of nursery stock a most unsatisfactory duty. His experience had been that the certificates of inspection were worthless, and he would be glad to see the system done away with and written guaranties of nurserymen substituted. W. G. Johnson gave an account of the success attending the inspection work and hydrocyanic-acid gas treatment in Maryland. The discussion was participated in by a number of others, the general opinion apparently being that inspection certificates are not reliable.

SECTION ON ENTOMOLOGY.

In the section on entomology a paper was read by C. M. Weed on The relation of nature studies in the schools to the biology of the college curriculum. This paper discussed briefly the historical development of the study of the natural sciences in American schools and colleges, showing the advance in the last 50 years.

SECTION ON MECHANIC ARTS.

The first paper read in this section was by O. L. Waller, entitled What shall be the character of the preparatory work required to enter four-year engineering-degree courses? By a vote of the section this paper was selected to be read in the general session (see p. 708).

A paper on Engineering standards and land-grant colleges, by W. H. Williams, was read by the secretary.

F. P. Anderson gave a brief account of tests which are being made at the Kentucky College of the hauling power and fuel consumption of locomotives.

The preceding account shows very clearly that by far the larger portion of the time of the convention was devoted to the consideration of questions of college policy and methods of teaching. The number of technical papers dealing with experimental methods and the results of investigation was relatively small as compared with previous conventions. The fact, however, that the convention voted decisively, in its action on revision of the constitution, against making the Association purely administrative in function would indicate that there is no abatement of its interest in investigational methods and results and no purpose to neglect this feature of its work.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of citrate-soluble phosphoric acid in Thomas meal, J. FREUNDLICH (*Chem. Ztg., 22 (1898), No. 92, pp. 974, 975*).—In a recent article P. Wagner proposed a new method for determining citrate-soluble phosphoric acid in Thomas slag, using citric acid instead of ammonium citrate. He pointed out that care should be taken to prevent the precipitation of silica along with the ammonium-magnesium phosphate, when the magnesia mixture is added.

This writer calls attention to another adulteration, which Wagner does not mention, viz, iron sulphid. By the action of the citric acid on the sulphids so often present in the slag, hydrogen sulphid is formed. When ammonia is added ammonium sulphid results, which, reacting with iron citrate, forms iron sulphid. To avoid weighing this with the ammonium magnesium phosphate, two precipitations are necessary, the iron sulphid in the first precipitate being oxidized by nitric acid or aqua regia.—J. T. ANDERSON.

Reynoso's method of analysis of phosphates, U. ANTONY and G. H. MONDOLFO (*Gaz. Chim. Ital., 28 (1898), pp. 142–147; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 12, p. 1186*).—In this method phosphoric acid combined with alkaline earths is removed by treating the ammonia precipitate with tin and nitric acid. The precipitate is heated with 77 per cent nitric acid and tin foil, cooled, filtered, and excess of ammonia added. The precipitate contains all the aluminum present and the filtrate the alkaline earths.

"From the precipitate which, in presence of phosphoric acid, is formed by tin and nitric acid, concentrated hydrochloric acid dissolves a compound which contains the phosphoric acid in the ratio PO_4: 7Sn, is soluble in alkalis, precipitated from alkaline solution by carbon dioxid, and is called by the authors phosphostannic acid. Tin and nitric acid react in presence of iron to form a compound slightly soluble in hydrochloric acid and soluble in cold alkalis, but precipitated as ferric hydrate, on boiling the alkaline solution. If the reaction takes place in presence of phosphoric acid, ferric phosphostannic appears to be formed."

A study upon the phosphoric acid dissolved in the soil solutions, T. SCHLŒSING, Jr. (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 4, pp. 236–239; 6, pp. 327–329*).—From a study of various methods of extracting soluble phosphoric acid from soils, the author concludes that shaking a given amount of soil with a fixed amount of water is a more reliable means than leaching with successive portions of water. The

method proposed is as follows: Shake 300 gm. of the soil for 6 hours with 1,300 cm. of water in a $1\frac{1}{2}$ liter flask, placed horizontally in a rotary machine making 2 revolutions per minute. Filter off 1 liter of the solution for the determination of phosphoric acid. The nature of the water used (even the presence of considerable amounts of carbon dioxid or bicarbonates) apparently has no great effect upon the result.

The amount of soluble phosphoric acid found by this method in different soils was very small, rarely exceeding 0.001 gm. per liter of extract, or 0.45 kg. per hectare. It appears that the amount of soluble phosphoric acid which water will remove from soil is the result of an equilibrium of two opposing classes of chemical action; one class tending to render the phosphoric acid insoluble, the other to make it soluble. This tendency toward equilibrium is believed to cause a constant renewal of soluble phosphoric acid in the soil as fast as it is used by the plants. Thus while the amount of phosphoric acid in this form in the soil at any given time is found to be exceedingly small, it is by no means unimportant as a factor of plant food supply.

Determining the density of sugar cane, A. A. RAMSAY (*Queensland Agr. Jour., 3 (1898), No. 5, pp. 359–361*).—The author recommends that a few canes, from 3 to 8, which apparently represent the average crop be selected and split into quarters longitudinally, one quarter being used for the extraction of the juice. The density of the thoroughly mixed juice from the different canes is determined by means of a saccharimeter or Brix spindle, the temperature of the juice being kept at about 20° C. In estimating the total soluble solids in the cane from the density thus determined it is assumed that the cane contains 10 per cent of fiber saturated with 90 per cent of juice. The equation thus becomes

$$\text{Soluble solids in cane} = \text{Density of juice} \times \frac{90}{100}.$$

The proteids of cream, E. F. LADD (*Jour. Amer. Chem. Soc., 20 (1898), No. 11, 858–860*).—In determining the casein, albumen, albumoses, and peptones in cream, the author dilutes 10 gm. of cream with 80 cc. of water and precipitates the casein with 3 cc. of saturated alum solution, the albumen in the filtrate by heating, the albumoses by saturating the filtrate with zinc sulphate, and the peptones by partially evaporating the filtrate and adding 80 per cent of the volume of absolute alcohol. Analyses are given of 1 sample each of fresh and ripened cream, the latter quite sour and ready for churning. These indicate that "the loss in working by these methods was not great, and further that there is not a very marked change in the proteids of cream during the process of ripening."

The fundamental principles of agricultural chemistry, R. OTTO (*Grundzüge der Agrikulturchemie. Berlin: Paul Parey, 1898, pt. 1, pp. 160, figs. 14*).—The work is intended for agricultural, forestry, and horticultural schools, as well as for self-instruction. This part is devoted to a discussion of the subjects of air and soil.

Some records of the year's progress in applied chemistry, W. McMurtrie (*Jour. Amer. Chem. Soc., 20 (1898), No. 12, pp. 967–987*).

Report of the chemist, E. Fulmer (*Washington Sta. Rpt. 1896, pp. 45–56*).—This is a brief summary of the work of the year ending June 30, 1896, and includes analyses of clays, chloropal, flaxseed, alum, limestone, hematite, cottonwood ashes, mineral water, coal, peat, fir ashes, water from city supply of Ballard, Washington, potatoes, Paris green, starfish ashes, corn juice, dried blood, bone, 7 samples of mixed fertilizers, muriate of potash, sulphate of potash, double manure salt, kainit, and conglomerates. Brief summaries are also given of results of investigations on the nitrogen content and humus of Washington soils (E. S. R., 9, p. 33).

Laboratory notes, F. H. Storer (*Bul. Bussey Inst., 2 (1898), VII, pp. 409–421*).—These include the determination of wood gum in the "doty" wood of the birch; the estimation of cellulose, lignic acids, xylan, and wood gum in peach stones; extraction of wood gum from the trunks of coniferous trees by cold dilute alkaline solutions; wood gum in the strawberry; the question of the presence of xylan in the membraneous covering of the starch grain; and an analysis of a sample of ashes left on burning the bamboo baskets in which sugar is exported from Java.

Micro-chemical detection of perchlorates in nitrate of soda, M. van Breukeleveen (*Rec. Trav. Chim., Pays-Bas, 17 (1898), pp. 94, 95; Bul. Soc. Chim. Paris, 19 (1898), No. 20–21, p. 863; abs. in Jour. Chem. Soc. [London], 74 (1898), No. 431, II, p. 482*).—The method proposed is as follows: Distil 10 gm. of nitrate in 100 cc. of water, add 50 cc. of 95 per cent alcohol, boil, and let stand for 2 hours to crystallize. Filter, evaporate to dryness, distil the residue in the least possible quantity of water, and test by Behren's method (mixing the solution with rubidium chlorid on a microscope slide and coloring (red) the rhombic crystals formed with potassium permanganate).

On the ignition of ammonium-magnesium phosphate with the filter paper, H. Mastbaum (*Ztschr. Analyt. Chem., 73 (1898), pp. 581, 582*).—The author places the filter while still wet in a crucible and heats at once in the full flame of a Bunsen burner, usually for 15 to 20 minutes, adds 2 or 3 drops of nitric acid, heats gently until the acid is expelled and then for a half a minute in the full flame. This method is considered rapid and convenient and fully as accurate as that proposed by Schmoeger,[1] in which the filter with the precipitate is dried in an oven before ignition.

The use of formaldehyde for the determination of noncoagulable albuminoids, especially as applied to the analysis of gelatin, A. Trillat (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1898), No. 6, pp. 544–546*).

Purification and decolorizing of sugar solutions by ozone, by electrolysis, and by both simultaneously, F. Peters (*Ztschr. Elektrochemie, 5 (1898), p. 265; abs. in Jour. Phys. Chem., 3 (1899), No. 1, p. 65*).—It was found that sirups were purified very much more effectively by the simultaneous action of ozone and of electrolysis than by either method taken singly.

Method of preparing protein from solutions, especially those from spirits, yeast, sugar, and starch manufactories, A. Glaser (*Neue Ztschr. Rübenz. Ind., 41 (1898), No. 15, pp. 160, 161*).—The process has been patented in Germany.

A chemico-physiological study of certain derivatives of the proteids, R. H. Chittenden, L. B. Mendel, and Y. Henderson (*Amer. Jour. Physiol., 2 (1899), No. 2, pp. 142–181, dgms. 9*).—The physiological effect of the cleavage products of antialbumids, antialbumoses, antipeptones, and other similar products derived from egg albumin and gelatin are reported, as well as studies of the chemical nature and general properties of these proteids.

The most important vegetable foods and condiments, A. E. Vogl (*Die Wichtigsten Vegetabilischen Nahrungs- und Genussmittel. Vienna: Urban & Schwarzenberg, 1899, pp. XV + 575, figs. 271*).—This volume, which is the outcome of the author's connection with the *Entwürfe für einen Codex alimentarius Austriacus,* is a manual

[1] Ztschr. Analyt. Chem., 73 (1898), pp. 308–310.

of the microscopical analysis of foods and condiments. Special attention is given to determining the purity of such materials and the detection and identification of the principal impurities and adulterants. Chapters are devoted to the analysis of flours and other milling products of cereals and leguminous seeds, and starches and sago, vegetables, fruits, tea, coffee, cocoa and similar products and spices. A chapter is also devoted to directions for recognizing with the microscope the more common adulterants of powdered spices.

Practical guide to the analysis of water, W. OHLMÜLLER (*Guide pratique pour l'analyse de l'eau. Paris: Librairie Polytechnique Baudry et Cie, 1898, pp. 289, pl. 1, figs. 77*).—Translated by L. Gautier from the second German edition of *Die Untersuchung des Wassers*.

Determination of organic substances in water, A. PAGNOUL (*Ann. Sci. Agron., 1898, II, No. 1, pp. 95, 96*).—Water containing, as a rule, 20 mg. of organic matter in various forms was tested with permanganate of potash immediately after preparation, and after standing 40 days in an open flask exposed to sunlight and in a closed flask in darkness. The results were very discordant and indicate that there is no reliable factor for calculating organic matter from oxygen absorbed.

On the facilities for standardizing chemical apparatus afforded by foreign governments and our own, L. A. FISCHER (*Jour. Amer. Chem. Soc., 20 (1898), No. 12, pp. 912–927, pls. 2*).—In addition to describing these facilities and discussing the standardizing of chemical apparatus, the author describes a device used by the Office of Standard Weights and Measures for making flasks, and recommends the adoption of the following units of measurement:

"(1) The liter, as defined by the International Committee of Weights and Measures, viz, the volume of the mass of a kilogram of pure water at the temperature of maximum density, and under a pressure of 760 mm. of mercury.

"(2) Density, defined as the ratio of the mass of a substance to that of an equal volume of pure water at its maximum density (4° C.).

"(3) The centigrade degree of the hydrogen thermometer of the International Bureau of Weights and Measures.

"I also recommend that some convenient temperature be adopted, at which all volumetric apparatus shall contain their stated capacities."

Extraction apparatus for laboratories, B. DONNER (*Chem. Ztg., 22 (1898), No. 94, p. 996, figs. 2*).—A convenient arrangement by which any number of extraction liquids may be used in succession on a given substance, without transferring it from one containing vessel to another. With one adjustment of the parts the apparatus acts as an ordinary continuous extraction apparatus. By substituting for the distillation flask with the extraction liquid another containing water and making a slight readjustment of the condenser, we have a steam drier so arranged that the liquid left in the substance is vaporized and is then recondensed and collected.—J. T. ANDERSON.

A new electric agitator, E. VAN MELCKEBEKE (*Bul. Assoc. Belge Chim., 12 (1898), No. 9, pp. 331–334, fig. 1*).—The stirring rods are attached to a metal rod carried by an armature oscillating between 2 electro-magnets, so arranged that the stirring rods may be given either a backward and forward or a rotary motion.

An improved apparatus for the estimation of carbonic acid in minerals, etc., A. MARSHALL (*Jour. Soc. Chim. Ind., 17 (1898), No. 12, pp. 1106, 1107, fig. 1*).—A method depending upon the measurement of the volume of gas evolved is described.

A new crucible—the tube crucible, E. MURMANN (*Monatsh. Chem., 19 (1898), p. 403, fig. 1; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 12, p. 1181*).—The crucible has a perforated bottom, ending in a straight or bent tube.

Collen's device for recovering the ammonium sulphate from coke ovens (*L'Engrais, 13 (1898), No. 44, p. 1046*).

BOTANY.

Economic grasses, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Bul. 14, pp. 85, figs. 91, pls. 3*).—This bulletin contains brief descriptions of 252 of the more important species of native and introduced grasses. Much of the matter presented has been published in a former bulletin (E. S. R., 8, p. 687). In the list of grasses for special soils or uses 38 species are given as hay grasses, 36 as pasture grasses, and 15 as lawn grasses; 25 as suitable for wet lands, 20 for embankments, and 20 for holding shifting sands. The descriptions of the species are arranged alphabetically according to scientific names, and a list of the common English or local names of the species also arranged alphabetically serves as an index. Some of the species suitable for lawns and shifting sands are discussed in other publications (E. S. R., 7, p. 492; 10, p. 551).

A report upon the forage plants and forage resources of the Gulf States, S. M. TRACY (*U. S. Dept. Agr., Division of Agrostology Bul. 15, pp. 55, figs. 20*).—The author briefly discusses and classifies the soils of the region and also its natural pastures. In the formation of pastures the essentials of a good pasture, selection of varieties, care of pasture lands, temporary pastures, and winter pastures are described. The value of alfalfa, Bermuda grass, cowpeas, crab grass, German millet, Johnson grass, and red clover for meadows is stated and various crops for soiling and fodder are mentioned. Some 60 grasses and 40 miscellaneous forage plants are described in greater or less detail as the more important hay and pasture plants of the region.

The Red Desert of Wyoming and its forage resources, A. NELSON (*U. S. Dept. Agr., Division of Agrostology Bul. 13, pp. 72, pl. 5, figs. 24*).—The author describes the location, extent, topography, geology, soils, climate, water supply, extent of settlement of the Red Desert, and indicates the different plant formations existing in that region. The amount and quality of forage is commented upon and suggested means for its improvement are given. The characteristic plants of the region are enumerated, and the winter range is said to consist largely of salt sages, sagebrushes, wheat grasses, Indian millet, giant rye grass, and the desert juniper. The vegetation of the hill country or summer range consists largely of species of Poa, brome grasses, drop seed, reed meadow grass, redtop, and sedges. Descriptive lists are given of the various forage plants of the summer range, and a general flora of the Red Desert completes the publication.

On the rôle of the awns of Gramineæ, N. I. VASILYEV (*Zap. Novo-Alexandri Inst. Selsk. Khoz. i Lyesor., 10 (1897), No. 2, pp. 119–168*).—The author undertook to verify the conclusions of Zoebel and Mikosch relative to the rôle of the beards as evaporating organs, also to ascertain whether this property is peculiar to the beards during certain periods of their development, and whether this peculiarity, which is so characteristic of the beards of barley, is possessed by other cereals. His

experiments were conducted upon varieties of the following plants: *Triticum durum*, *T. vulgare*, *T. amyleum dicoccum;* rye, barley (*Hordeum vulgare*, *H. distichum*, *H. tetrastichum*), and *Stipa capillata*. The experiments were conducted by cutting under water the heads from the stalk and placing them in test tubes of distilled water, the heads being supported by a wire so that the stalks did not reach the bottom of the test tube. Vegetable oil was poured over the water to prevent its evaporation. From some of the heads the beards were removed; others remained intact. The experiments were continued 2 to 3 hours and frequent weighings were made. The amount of evaporation was calculated to the unit of weight of the head.

Summing up his investigation, the author concludes that when the beards are large at certain stages of development they evaporate the greater amount of water given off by the head, and cutting off the beard strikingly diminishes the transpiration. In experiments with Byeloturka wheat it was found that 63.3 per cent of the water transpired by the head was from the beards, and in another variety 60.3 per cent of the total water evaporated was transpired through the beards. In his experiments with *Stipa capillata* 67 per cent of the total was given off through the awns.

The intensity of evaporation is a temporary phenomenon possessed by Byeloturka and black bearded wheat at the period of flowering, while in the case of Stipa it was most abundant at the time when the seed was in the milk stage. The percentage of transpiration by the beards of Byeloturka varies from 22 per cent during early stages to a maximum of 63.3 per cent and falls to 16.6 per cent during the period of ripening.

In relation to light, humidity, and the other factors which influence evaporation, the author finds that the beards are not particularly sensitive compared with other parts of the ear. The variation in the amount of evaporation the author thinks is probably due to changes in the anatomical structure of the beards, and suggests this can only be determined by a thorough study of their anatomy.

The removal of the beards from a part of the spikelets lowered the weight of grain as much as 9 per cent in one experiment, seeming to indicate that the presence of the beards is favorable to the proper filling of the grain.—P. FIREMAN.

On the vegetative period of plants, L. P. NILSSEN (*Tidsskr. Norske Landbr.*, *5* (*1898*), *No. 5*, *pp. 283–286*).—The writer discusses the question of the length of the vegetative period of cultivated plants in the far north, as compared with that in more southern regions. Without giving much direct evidence or results of prolonged observations, he maintains that the popular idea is erroneous that owing to the prolonged light during the summer months at the arctic circle plants mature more rapidly there than farther south. While the average growing period for six-rowed barley is placed at about 95 days for southern Norway, and for oats about 112 days, he finds that the period

is, on the average, for Nordland's *amt* (Norway, 65 to 69° latitude), for barley 103½ days, oats 113¼ days, spring rye 111 days. While light is a potent factor in plant growth, it is only one of the important factors; a sufficient supply of heat and moisture are as essential, and northern regions are especially at a disadvantage as regards the former.—F. W. WOLL.

A study of the roots of perennial plants, E. S. GOFF (*Wisconsin Sta. Rpt. 1897, pp. 286–298, figs. 6*).—The author states that while the root growth of many annual crops has been more or less thoroughly investigated, the study of roots of perennial plants seems to have been to a large extent neglected. A modification of the root cage previously described (E. S. R., 5, p. 480) was made. In order to expose the roots more fully to view, instead of the iron cage there described, a wide board was used and wires thrust through holes bored through it. This apparatus was soon found to be unsuitable, and a slatted frame was substituted for the boards with perfect success. Studies were made of the roots of strawberry, raspberry, grape, and apple trees.

The roots of the strawberry were contained within a very small compass, the deepest extending a little less than 2 ft., while the horizontal roots reached scarcely beyond the area covered by the leaves. This limited root range of the strawberry plant readily explains its well-known susceptibility to drought, as well as its ready response to fertilizers. These studies emphasize the importance of providing for irrigation wherever large and regular crops are to be depended upon and also suggest the importance of a method of culture whereby the rows of plants should be slightly lower than the spaces between the rows.

The roots of the raspberry were found to extend horizontally a distance of 4 ft., and vertically something more than 5 ft. The shallowness of the main root is noticeable, as well as the large number of vertical roots. The shallow depth traversed by the main root would suggest the inadvisability of too deep plowing between the rows.

The author states that as the grapevine is not required to support its own trunk and in culture is heavily pruned each year, he had anticipated rather shallow and scanty root development. It appears, however, that almost no roots were found at a depth less than 18 in. The main root continued something more than 13 ft. Dead roots in the upper layers of soil were frequently observed. Whether these shallow roots had been destroyed by severe freezing or whether they had perished on account of the severe drought of 1894 and 1895 is unknown. Below the main root the whole system seemed to be alive and for the most part in excellent condition. The soil was rather light clay loam to a depth of about 2 ft.; below this was a layer of sandy clay, 2½ ft. thick, resting on a stratum of heterogeneous drift gravel consisting of loose sand mingled with pebbles mostly of small size, but a few larger than a man's fist. The longer vertical roots extended with comparatively few branches into this gravel stratum. The numerous white root tips indicated that the roots were active at a depth of 6 or 8 ft.

The roots of several apple trees were examined, one of which had been planted 7 years on a rather poor soil. The larger roots varied from 1¼ to 2 in. in diameter, and the root system extended horizontally on one side a little more than 12 ft. and vertically about 9 ft., from which it appears that the tree drew its sustenance from a cylinder of soil something more than 24 ft. in diameter and 9 ft. in depth, representing a total volume of about 150 cubic yards. Comparisons were made between a seedling tree 4 years old and 2 root-grafted trees 3 years from the graft. The difference in the forms of the crown of the root was found to be quite marked in the 2 methods of growth. In the seedling no abnormal growth was perceptible, while in the part of the trees grown from root grafts the growth of the crown was abnormal. In the seedling a strong tap root was developed, while in the root grafts there was no semblance to a tap root. If these abnormal growths generally follow root grafting, the author suggests that some substitute for this system might prove acceptable in the northwestern States.

Evaporation and plant transpiration, W. MAXWELL (*Jour. Amer. Chem. Soc., 20 (1898), No. 7, pp. 469–483*).—The author reports experiments on the amount of moisture directly evaporated from the soil, and the relative proportion that escapes by transpiration from sugar cane during the different periods of growth. The methods followed in the experiments were briefly as follows: One hundred and twenty-five pounds of a particular soil was placed in each of 2 tubs with perforated bottoms, over which a piece of linen cloth was laid before putting in the soil to prevent the earth falling through or blocking up the holes. When filled with soil the tubs were set into galvanized iron pans containing water which was kept at a constant level. The pans were covered with moisture-proof glazed cloth to prevent any evaporation from the water surface. All evaporation of water would necessarily have to take place through the surface of the soil and the transpiration of the plant. In one tub 3 pieces of seed cane were planted, while the other was kept as a check. The tubs were placed upon a veranda having a southern exposure with a strong light, but protected against rainfall. The mean outdoor and indoor evaporation, humidity, direction of the wind, and other meteorological data were secured, which, together with the amount of evaporation from the 2 tubs, is tabulated.

The experiment was continued for 7¼ months. The water evaporated from the soil in tub No. 1 was 83,140 gm., and the water evaporated from the soil and transpired by the cane in tub No. 2 was 167,250 gm., thus showing that the cane transpired during the period indicated 84,110 gm. As the total amount of dry matter produced during the period of growth was 568.9 gm., for each gram of water-free sugar cane material produced 147.8 gm. of water was transpired. The amount of water transpired by the plant is given by monthly periods, and from the data collected the author thinks some important conclusions relative to practical irrigation could be drawn. "To apply the

same volume of water at the time of planting and during the early period of growth, when transpiration is very low, that is required by the cane later in development, incurs a great loss of water and of soil constituents that the water removes."

The fertilization of cultivated legumes, C. FRUWIRTH (*Ueber Befruchtungsverhältnisse bei Hülsenfrüchten. Plieningen: Friedrich Find, 1898, pp. 50*).—The floral biology of the cultivated legumes in general is discussed and a detailed study according to the methods of Darwin, Herman Müller, and Delpino is made of about 30 species of economic importance, and notes given on adaptation to cross fertilization and on insect visitors. Three brief series of experiments were performed to determine to what extent cross fertilization is necessary for each species, (1) legumes grown in the field being covered with netting, (2) single plants grown in an inclosed space, and (3) single flowers in the field covered. The results of these experiments are given in the individual discussion of each species. Various notes on order of opening of the inflorescence, crossing, and setting of fruit are interspersed. These investigations developed the fact that in most species of legumes self-fertilization takes place quite readily. It was found that a relatively small setting of fruit in many species is not due so much to lack of insect visitors as to exceptional causes. Covering the plants does not exclude small creeping insects, and probably these are important agents in cross fertilization. Of those species in which self fertilization could not be demonstrated much less fruit set on covered plants than on others.

Alinit, GERLACH (*Chem. Ztg., 22 (1898), No. 77, p. 789*).—A brief abstract of a paper read before the German Association of Naturalists and Physicians. An examination of samples of this material showed that instead of being a pure culture, as is claimed, various organisms were present, among which are mentioned a bacillus similar to the hay bacillus, a sarcina, a species of red yeast, and an organism similar to the potato bacillus.

Culture experiments were undertaken to test the effect of this substance in growing barley, rye, wheat, and white mustard, but no improvement due to the inoculating substance was found. In the discussion following the reading of the paper, Tacke, Wilfarth, and Nobbe, agreed with the author that Alinit was without beneficial effect in aiding in the nitrogen assimilation of cereals, etc.

Experiments with Nitragin, E. WOLLNY (*Vrtljschr. Bayer. Landw. Rath., 3 (1898), No. 2, pp. 171–184*).—The author concludes from his investigations that soil inoculation with Nitragin or material from fields where leguminous crops have been successfully grown gives little or no increased yield in humus soils. Upon poor soils and especially upon sandy soils inoculation may prove successful, but similar or even more striking results might have been obtained with fertilizers. Inoculation where yellow lupines, serradella, or other calcifugous Leguminosæ are

grown on lime soils, is without effect, while the proper application of combined nitrogen in suitable fertilizers will prove advantageous in increasing plant growth. In general a small quantity of nitrogenous fertilizer may be profitably added to soils where root tubercle bacteria are present in considerable quantity.

On the assimilability of organic nitrogen in sterilized media, A. LYEBYEDYEV (*Selsk. Khoz. i Lyesov., 186 (1897), No. 7, pp. 159–169*).—Sand cultures were conducted with barley in which 2 seeds were planted in each of 11 vessels, the sand having been previously sterilized by ignition and washed with hydrochloric acid. The sources of nitrogen supplied were urea, hippuric acid, leucin, aspartic acid, and asparagin. Carbonate of lime was added so as to render the different cultures as nearly neutral as possible. Part of the vessels were sterilized; the others not. To the lots which were not sterilized a few drops of aqueous soil extract were added. All the seeds, whether in sterilized or nonsterilized vessels, were placed for one minute in a 5 per cent solution of corrosive sublimate before planting. During the experiment, which lasted from July to September, particular pains were taken that the water which was given the plants should in no way convey bacteria to the cultures. The results obtained are shown in the following table:

Assimilation of organic nitrogen by barley.

Source of nitrogen.	Not sterilized.					Sterilized.				
	Weight of water-free substance.			Number of grains.	Average weight per grain.	Weight of water-free substance.			Number of grains.	Average weight per grain.
	Roots.	Straw.	Grain.			Roots.	Straw.	Grain.		
	Grams.	*Grams.*	*Grams.*		*Gram.*	*Gram.*	*Gram.*	*Gram.*		*Gram.*
Hippuric acid	0.273	0.819	0.018	5	0.0036	0.006	0.017	....	....	....
Urea	.112	.666	....	....	....	.013	.032	....	....	....
Leucin	1.101	2.028	1.117	43	.024	.071	.223	....	....	....
Asparagin	.528	1.688	.726	42	.017	.211	.346	0.153	5	0.037
Aspartic acid	.257	1.327	.366	29	.013	(*a*)	....	....	....	....
Calcium nitrate	1.512	4.630	3.945	79	.05	(*b*)	....	....	....	....

a Vessel holding culture broken. *b* No duplicate of this lot in sterilized sand.

From the above table it is shown that under the conditions of this experiment the seeds germinated in sterilized media, but with the exception of those which had received asparagin were unable to develop their plants to any considerable extent. The experiment, however, corroborates the claim that in sterilized media plants can obtain some nutrition from organic compounds containing nitrogen.—P. FIREMAN.

The geographical distribution of cereals in North America, C. S. PLUMB (*U. S. Dept. Agr., Division of Biological Survey Bul. 11, pp. 24, map 1, figs. 3*).—The author has sought to give the distribution of varieties of corn, wheat, and oats adapted to the different life zones as elaborated by Dr. Merriam of this Department. The information upon which this work is based was secured by sending blanks to about 2,500 grain growers throughout the United States and Canada. From the

replies received, which numbered 1,033, it appears that in many localities but little attention is paid to keeping varieties pure, and many farmers use mixed, unknown, or local varieties of ordinary merit for seed. The gradual acclimation of cereals through years of selection and cultivation is claimed to have produced varieties much better adapted to one zone than another, and upon this theory the author has mapped the distribution of 15 varieties of corn, 13 of wheat, and 7 of oats.

Life zones and crop zones of the United States, C. H. MERRIAM (*U. S. Dept. Agr., Division of Biological Survey Bul. 10, pp. 79, map 1*).—The present report is designed to explain the relations of the study of the geographical distribution of the native animals and plants to practical agriculture. The bulletin is divided into four parts as follows: (1) Relations of the Biological Survey to practical agriculture, (2) life zones of the United States—boundaries, native species, and important crops, (3) laws of temperature control of the geographic distribution of animals and plants, and (4) crop tables.

The first part is a reprint from the Yearbook of this Department for 1897; part 2 discusses the life zones of the United States, their boundaries, native species, and important crops. As recognized by the author, the life zones of the United States are 6 in number, with several minor subdivisions. In the third part the author states his views relative to the effect of temperature in controlling geographical distribution of animals and plants, and gives the following law based upon his investigations: "The northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction, and the southern distribution is governed by the mean temperature of a brief period during the hottest part of the year." The sum of the positive temperatures is secured by adding together for the entire growing period the average daily temperature in excess of 6° C. (43° F.). The length of period which controls the southern distribution has not been definitely determined, but it is thought to be approximately the 6 hottest consecutive weeks. In the table showing the governing temperatures of zones, instead of the sum of the normal mean daily temperatures above 6° C., as stated, the figures given are those of the total temperatures for the entire growing period. Attention has been called to this.[1]

In the fourth part of the bulletin the zone ranges are given for the more important varieties of cereals, and for apples, apricots, cherries, grapes, peaches, pears, plums, strawberries, nuts, etc. In compiling these ranges it became apparent that some varieties extend over wide areas, thriving in many zones, while a few are confined to a single zone.

On plant culture and plant diseases, M. F. NILSSEN (*Tidsskr. Norske Landbr., 5 (1898), No. 5, pp. 241–282*).—Report of work done by Swedish and Danish experiment stations in plant culture and plant diseases.

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[1] Science, n. s., 9 (1899), No. 212, p. 116.

Meadow plants of Central Franconia, R. BRAUNGART (*Vrtljschr. Bayer. Landw. Rath., 3 (1898), No. 1, p. 52*).—Gives notes on the occurrence and relative value of the grasses, leguminous plants, and weeds growing in meadows.

Eragrostis brownii as a forage plant, J. H. MAIDEN (*Agr. Gaz. New South Wales, 9 (1898), No. 10, pp. 1131, 1132*).—The value of this grass as a forage plant is questioned. Although growing well and withstanding heat it is said to be harsh and not readily eaten by stock.

Rhea, or China, grass, G. WATTS (*Agr. Ledger, 1898, No. 15, pp. 129, pls. 4*).—A review of the existing information relative to this plant, *Bœhmeria nivea.*

A sand binding plant dangerous to horses, J. H. MAIDEN (*Agr. Gaz. New South Wales, 9 (1898), No. 10, p. 1131*).—Notes are given of *Gnephopsis eriocarpa*, which from its habit of growth is dangerous to horses, since in eating it they are liable to get large amounts of sand in their stomachs.

Trifolium pratense perenne and T. medium, F. NOBBE (*Mitt. Deut. Landw. Gesell., 13 (1898), No 22, pp. 345, 346, figs. 2*).—A note describing the difference between these clovers.

Notes on poisoning and poisonous plants (*Deut. Landw. Presse, 25 (1898), No. 58, p. 645; 61, p. 673*).

New or noteworthy Alabama fungi, F. S. EARLE (*Bul. Torrey Bot. Club, 25 (1898), No. 7, pp. 359–368*).—As a contribution from the Alabama Biological Survey the author has given important notes and descriptions of a number of species of fungi. Among those described as new are *Micropeltis alabamensis* on living leaves of *Magnolia virginiana; Anthostomella sphærotheca* and *Gnomia sabalicola* on dead petioles of *Sabal adansoni; Botryosphæria arundinariæ* and *Trichosphæria underwoodii* on dead stems of Arundinaria; *Metasphæria nigromaculans* on dead stems of *Agave virginica; Nectria (Eunectria) meliæ* on dead twigs of *Melia azedarach; Aulographum confluens* and *Lophodermium rubiicolum* on dead stems of blackberry; *Phyllosticta arida* on *Acer negundo; P. macroguttata* on *Meibomia* sp.; and *Cercospora ribis* on leaves of cultivated gooseberry. In regard to the last-named fungus the author says: "This conspicuous and well-marked species attacks the gooseberry foliage abundantly, causing it to fall prematurely. It is probably one of the causes of the failure of the fruit in this region."

Biological studies of Penicillium glaucum, F. GUÉGUEN (*Bul. Soc. Mycol. France, 14 (1898), No. 4, pp. 201–255, pls. 4*).

On the saprophytic development and cytological structure of the yeast-like sporidia of Ustilago maydis, R. MARIE (*Bul. Soc. Mycol. France, 14 (1898), No. 4, pp. 161–173, pl. 1*).

Structure of the fruit of some Gramineæ, P. GUERIN (*Jour. Bot. France, 12 (1898), No. 23–24, pp. 365–374, figs. 12*).—Studies are reported upon Eleusine, Dactyloctenium, Crypsis, Sporobolus, and Zizaniopsis, the fruit of each of which is said not to be a true caryopsis.

Studies of the flax fiber, A. HERZOG (*Oesterr. Chem. Ztg., 1 (1898), No. 1, pp. 310–312; 2, pp. 335, 336, figs. 7*).—Microscopical and chemical studies are given of the flax fiber.

On the elongation of nodes, P. VAN TIEGHEM (*Ann. Scottish Nat. Hist. Soc., 8. ser., 5 (1898), No. 1–2, pp. 155–160*).

Memoirs of the Institute of Forestry at St. Petersburg (*Izvyestia S. Peterburgskavo lyesnovo Instituta. St. Petersburg, 1898, pt. 1; rev. in Selsk. Khoz. i Lyesov., 190 (1898), No. 7, pp. 458, 459*).—Of various articles in the publication, that on the liberation of heat by germinating seeds by A. Tolski may be mentioned.

On the growth of Nostoc punctiforme in absolute darkness, R. BOUILHAC (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 22, pp. 1583–1586*).—It is stated that this plant is able to grow in absolute darkness if provided with suitable organic material, such as glucose. Under these conditions it will produce green plants. The color, it is said, is due to chlorophyll, since the alga was able to decompose carbon dioxid and also as shown by spectrum analysis of the plants themselves.

The rôle of chlorophyll in sugar production (*Rev. Agr. Reunion, 2 (1898), No. 9, pp. 425-430*).—An important rôle in sugar production is shown for chlorophyll, and it is stated that the sugar content is lowered whenever the leaves are attacked by fungi or insects which cause a loss of chlorophyll.

So-called assimilation, C. R. BARNES (*Bot. Centbl., 76 (1898), No. 8, pp. 257-259*).—Attention is called to the necessity of some specific word for the process of the manufacture of carbohydrates by plants. The author states that in 1893 he suggested photosyntax as such word. Photosynthesis has since been used by a number of writers, but the author objects to this word as etymologically less accurate than the term proposed by himself.

Concerning the assimilation of nitrates by phanerogams in the dark, U. SUSUKI (*Bot. Centbl., 75 (1898), No. 10, pp. 289-292*).

On the synthesis of proteid materials by plants, W. PALLADIN (*Sep. Adbr. Arb. Naturf. Gesell. Univ. Charkov, 33 (1898), pp. 8*).

The formation of asparagin in the plant, E. SCHULZE (*Landw. Jahrb., 27 (1898), No. 3-4, pp. 503-520*).

Root tubercles of leguminous plants, A. V. BERTHOUMIEU (*Rev. Sci. Bourbonnais, 11 (1898), No. 129-130, pp. 166-175, pl. 1*).

ZOOLOGY.

Cuckoos and shrikes in their relation to agriculture (*U. S. Dept. Agr., Division of Biological Survey Bul. 9, pp. 26, pl. 1, fig. 1*).—*The food of cuckoos, F. E. L. Beal* (pp. 1-14).—On the basis of an examination of a large number of stomachs, the food of cuckoos is described and a list is given of the insects identified. It is stated that from an economic standpoint cuckoos rank among the useful birds, since their diet consists very largely of insects and caterpillars found on trees and shrubs.

The food of shrikes, S. D. Judd (pp. 15-26).—The contents of the stomachs of a number of shrikes was examined and a list is given of the birds, mammals, and insects consumed. The author notes that although shrikes destroy birds, they destroy many mice and insects also. Their beneficial qualities are thought to outweigh their injurious qualities 4 to 1.

The winter food of the chickadee, C. M. WEED (*New Hampshire Sta. Bul. 54, pp. 85-98, figs. 11*).—The different insect eggs which chickadees eat are described, and observations on the abundance and food habits of chickadees in New Hampshire are reported. The investigations indicate that the chickadee should be encouraged, since throughout the winter it destroys large numbers of insect enemies of the farm, orchard, and garden.

The fact is pointed out that the presence of chickadees may be encouraged by suitable trees for shelter, and by placing suet or bones in trees where the birds may obtain them during the winter.

Feeding habits of the chipping sparrow, C. M. WEED (*New Hampshire Sta. Bul. 55, pp. 101-110, fig. 1*).—A careful record, covering one day, was made of the number of times a pair of chipping sparrows (*Spizella socialis*) left their nest, and the food which they brought to their young when they returned. The fact is noted that they frequently removed excrement from the nest.

"During this busy day the parent birds had made almost 200 visits to the nest, bringing food nearly every time, though some of the trips seemed to be made to furnish grit for the grinding of the food. There was no long interval when they were not at work, the longest period between visits having been 27 minutes. Soft-bodied caterpillars were the most abundant elements of the food, but crickets and crane flies were also seen, and doubtless a great variety of insects was taken. The precise determination of the most of the food brought was of course impossible, the observations having been undertaken especially to learn the regularity of the feeding habits of the adult birds. That they were busy from daylight to dark with no long intermission at any time is shown by the record. . . . The bird certainly deserves all the protection and encouragement that can be given it."

Joint report of the botanist and entomologist and the veterinarian on spermophile or ground-squirrel investigations, C. V. PIPER and S. B. NELSON (*Washington Sta. Rpt. 1896, pp. 26-29*).—Brief statements are made concerning the life-history studies of the ground squirrel and experiments to exterminate it by poisons and by bacterial diseases.

AIR—WATER—SOILS.

Percolation, storage, and movement of water in the soil, P. P. DEHÉRAIN (*Ann. Agron., 24 (1898), No. 10, pp. 449-481, charts 4*).—An account is given of laboratory experiments with 200-gm. samples of soil to determine the difference in storage capacity, permeability, and capillary power of loose and compact soils. The results show that the loose soil is much more permeable and has a greater storage capacity for water than the compact soil. After prolonged rain, however, the capacity for water of the loose soil may gradually diminish until it becomes less than that of the compact soil at the beginning. Water percolates easily through loose soils, and thus a large reserve of moisture collects in the subsoil. On the other hand, water percolates slowly through compact soils, is subject to great loss by evaporation, and does not collect except in small quantities in the subsoil.

This subject was also investigated in vegetation boxes in which different crops were grown. The results confirm those obtained in the laboratory experiments. It was found that in the case of the loose soil a reserve of moisture collected in the subsoil within reach of the roots of plants, such as wheat and alfalfa. Water, however, rose by capillarity much more readily in the compact soil than in the loose soil.

The practical application of the facts demonstrated in these experiments is briefly discussed.

Percentage of water retained by long columns of sand, F. H. KING (*Wisconsin Sta. Rpt. 1897, pp. 254-256*).—Attention has been called in a previous report of the station (E. S. R., 8, p. 297) to the long-continued percolation of water from sands of different grades in cylinders 8 ft. long and 5 in. in diameter. Further observations on this subject are here reported. Tables show the amounts of water which percolated from the cylinders as measured at intervals, from February 7, 1894, to September 28, 1896, as well as the amount of water remaining in different sections (3 in.) of the columns at the latter date.

"These observations show very conclusively that the drying out of coarse, sandy subsoils may take place to so extreme a degree as to almost approach the so-called hygroscopic moisture dryness, no matter how perfect a mulch may be maintained over them, provided the interval between rains is long enough. They further show quite as conclusively that the coarse, sandy soils, no matter how inherently rich they may be in plant food, must remain unproductive in all localities where the ground water is not near the surface, unless good showers fall at short intervals or unless the rains are supplemented by irrigation."

The treatment of swamp or humus soils, F. H. KING (*Wisconsin Sta. Rpt. 1897, pp. 232–239, figs. 10*).—This is a continuation of previous experiments (E. S. R., 9, p. 536) on recently reclaimed swamp land. In the earlier experiments with corn little or no increase of yield was observed where commercial fertilizers had been applied, but there was a very decided improvement where barnyard manure had been used. Oats and barley following the corn derived decided benefit from the barnyard manure applied the previous year, but none from the commercial fertilizers so applied. Plats which had produced a uniformly good crop of corn in 1896 gave very irregular yields in 1897. Experiments were made in the plant house with soils taken from spots which had given good crops as well as from those on which the crops were poor. The pots used in these experiments were galvanized-iron cylinders 3 ft. in diameter and 4 ft. 4 in. deep, and held 2,200 lbs. of soil. Twenty-four of these pots were devoted to corn, 4 to oats, and 8 to clover, one-half in each case being filled with productive soil, the other with unproductive soil.

"In 4 of the cylinders planted to corn the soil was put in as loosely as possible, in order that it might be better aerated, while in all the others the soil was closely packed to imitate the field conditions. With 4 other cylinders cut, dry straw was worked into the surface 8 in. of the soil with a view to better aerating it by another method which might be presumed to imitate the conditions produced by the grass turned under with the first plowing of these fields, and also the mechanical effect of farmyard manure. Four other cylinders were given a dressing at the rate of 30.8 tons of farmyard manure per acre, both for better aeration and to supply new materials from which nitrates might be developed. Another 4 cylinders were given a dressing of sodium nitrate at the rate of 400 lbs. per acre, in order that available nitrates might be present to start with. Still another 4 were given potassium carbonate at the rate of 400 lbs. per acre, while the remaining 4, planted to corn, were given nothing and held as a check upon the first 4 which had the loose soil, these being filled with the firmed soil and presumably not so well aerated."

Three crops of corn in succession have been planted in these cylinders. In case of the first crop the yield was best on the manured cylinders. The yields on the cylinders receiving potash and cut straw stood next, the crop being equally benefited by these 2 materials. No benefit was derived from the nitrate applied. The yields were no better on the loosely packed soil than on the firmly packed soil.

"In the case of the second crop of corn the manured cylinders are decidedly ahead, while the cut straw, nitrate, and potash cylinders are about equally improved over the 2 sets of untreated cylinders, which again are about alike and show nothing gained or lost by the loose packing. . . .

"When the third crop came to be planted in July a very heavy crop of oats had been harvested from 4 oat cylinders, yielding over 12 tons of water-free matter per acre, and a good crop of clover had been taken from the clover cylinders. The 4 oat cylinders and 2 of those bearing clover were fitted for corn and planted with the others. . . .

"The corn on the oat stubble look decidedly as though it was nitrogen hungry, but the oats had an extremely dark-green look and seemed to be overfed with nitrogen rather than underfed. The clover made a good fair growth for the first crop, but it was not as large as the crop grown in the small cylinders on the upland soil, while the second crop was decidedly poor for some reason. But a good crop of corn followed the clover.

"This much seems clear in regard to the treatment of these black marsh soils, they respond well to farmyard manure, and even to coarse litter of any kind when well worked in, while the commercial chemical fertilizers tried, other than potash, have but little influence."

Fertilizer experiments with Indian corn on marsh soils, F. W. Woll (*Wisconsin Sta. Rpt. 1897, pp. 264–271*).—This is an account of chemical investigations made in connection with experiments previously reported in part (E. S. R., 9, p. 536). In these experiments it was assumed that the marsh soil was abundantly supplied with nitrogen. For this reason the fertilizers used included only different forms of potash, phosphoric acid, and lime. The yield (grain and fodder) and the dry matter and nitrogen in the crops grown were determined, and the results are classified with reference to the degrees of fertility (poor, medium, and good) of the soil on which the crop was grown, as shown by chemical analysis.

While it is not considered safe to draw conclusions from results of one year's experiments, it is believed that the data obtained tend to show that the fertility of these soils "is in direct proportion to the content of potash, phosphoric acid, total nitrogen and active nitrogen (nitrogen soluble in water, expressed in parts per million), and in inverse proportion to the lime content of the soil."

The composition of the different grades of soil was as follows:

Composition of marsh soils from unfertilized plats.

Constituents.	Poor soil.		Medium soil.		Good soil.	
	First foot.	Second foot.	First foot.	Second foot.	First foot.	Second foot.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Insoluble matter	72.11	81.48	74.49	79.92	73.57	79.49
Volatile matter	12.30	4.82	11.35	5.80	11.73	4.38
Potassium oxid	.26	.35	.27	.34	.30	.34
Calcium oxid	1.44	1.49	1.35	1.21	1.05	1.32
Phosphoric acid	.18	.13	.20	.14	.22	.15
Nitrogen (total)	.37	.05	.32	.10	.41	.12
Nitrogen soluble in water (parts per million)	36.2	....	46.2	....	50.1	....

"The most plausible explanation of the different productive capacities of the poor, medium, and good soil lies, it would seem, in their different contents of active (nitric) nitrogen. For some reason or reasons as yet not understood, conditions in the poor soils have been unfavorable to the process of nitrification or favorable to denitrification. . . .

"The result of the investigation shows beyond a doubt that although some of the fertilizers applied did not appreciably increase the yield of fodder corn or ear corn, the quality of the product was in every case improved by the application of the fertilizers, both through the larger content of valuable food constituents in the corn and through the greater proportion of ears to stover in the crop from the fertilized plats."

Pot-culture tests of the productiveness of the soils of Minong pine barrens in Douglas County, Wisconsin, F. H. KING (*Wisconsin Sta. Rpt. 1897, pp. 249–253, fig. 1*).—There are "in the central and northern portions of Wisconsin large areas of very sandy soils which, if they ever become remunerative for agricultural purposes, must be made so through the application of special methods." Pot experiments with samples of such soils from Minong in Douglas County during 1895 and 1896 indicate that with irrigation combined with judicious fertilzation good crops may be produced on soils of this character. The crop grown in these experiments was potatoes. The soils were irrigated once or twice each week during the season. The yield in the pots to which well rotted manure had been added was at the rate of 275.8 bu. in 1895 and 878.1 bu. in 1896. The water used by the crop was 16.39 in. in 1895, 29.51 in. in 1896.

For purposes of comparison similar experiments with potatoes were made on samples of local sands. The water used, including 4.48 in. of rainfall, was 20.05 in. in 1895. The yield on heavily manured soil (50 tons per acre) was at the rate of 605.5 bu. per acre; on soils receiving only 25 tons manure, 563.5 bu. In 1896 potatoes were again grown, without further manuring. The yields were 312 bu. per acre for the heavy watering (40.61 in. including rainfall) and light dressing of manure, and 344.5 bu. for the lighter watering (31.92 in.) and heavier dressing of manure.

Experiments of the above character were also made on the same sands and on good soil with clover in 1895 and barley in 1896. "While the crops produced on the sand have not been as large in all cases as those produced on the good soil, they have nevertheless been fair yields and nearly equal to those from the good soil when the sum of both crops is compared."

Results of studies of the higher atmosphere, G. HERMITE and C. BESANÇON (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 16, pp. 574, 575, fig. 1*).—A small balloon was sent up August 23, 1898, to an altitude of about 7,305 meters. The balloon carried a barothermograph and a good automatic record of temperature and elevation was obtained. The minimum temperature recorded was —60° C. at about 6,500 meters.

Soil water, P. P. DEHÉRAIN (*Gard. Chron., 3. ser., 25 (1899), No. 630, p. 34*).—A scientific presentation in popular style of the principles governing the operations of tillage in their relation to control of soil moisture.

Studies on the surface tension of water in small capillary tubes, P. VOLKMANN (*Ann. Phys. u. Chem.* [*Wiedemann*], *n. ser., 64 (1898), No. 10, pp. 194–206*).

The farm water supply, F. W. MORSE (*New Hampshire Sta. Bul. 53, pp. 73–81*).—This bulletin discusses in a popular manner the character of the natural water supply in New Hampshire, the nature and causes of pollution, and the means of preventing contamination. The discussion is based upon analyses made at the station of numerous samples of well and spring water. It is shown that most of the natural waters of New Hampshire are very pure and soft. The unpolluted ground water contains as a rule less than 10 parts of solid matter dissolved in 100,000 parts of

water. Waters contaminated by drainage from the surface almost invariably contain a much larger solid residue and a higher proportion of chlorin than unpolluted water.

The conveyance of bacteria by underground water, E. PFUHL (*Ztschr. Hyg. u. Infectionskrank., 1897, p. 549; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 7, p. 687*).—By means of pits dug to the water level in gravelly soil it was found that *Micrococcus prodigiosus* and fluorescent Vibrio were carried by the ground water through 8 meters (26.25 ft.) of soil in from 1 to 2 hours. "In further experiments the *prodigiosus* bacilli were found to pass into the supply of a tube well drawing its water through gravel for a distance of 3.7 meters (12.14 ft.) from the point where the cultures of bacteria were introduced into the water near the surface."

Studies on the composition of nitrate-bearing soil from the site of ancient Cairo, J. ZAMARON (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1898), No. 6, pp. 553, 554*).—Analyses of the soil from ancient rubbish heaps are reported, which show, among other things, an average of 2.19 per cent of nitric nitrogen, corresponding to 4.1 per cent of potassium nitrate.

On the influence of crops and manure on the nitrogen content of soils, C. F. A. TUXENS (*Landw. Vers. Stat., 50 (1898), No. 5-6, pp. 335-342*).—For an abstract of this article as it appeared in another journal, see E. S. R., 10, p. 425.

On the pulverization of the soil, M. RINGELMANN (*Jour. Agr. Prat., 1898, II, No. 42, pp. 558-561, fig. 1*).—A popular discussion of this subject.

Treatment of the soil; a question for the consideration of the farmers, W. G. WARING (*Tyrone, Pa.: Tyrone Times, 1898, pp. 11*).

The bringing of soil under culture, M. RINGELMANN (*Jour. Agr. Prat., 1899, I, No. 3, pp. 92, 93*).—A brief, popular note on this subject.

On the cultivation of the soil, E. WOLLNY (*Deut. Landw. Presse, 25 (1898), No. 80, pp. 856, 857; 88, pp. 932, 933; 89, pp. 941, 942*).—A discussion of the physical properties of soils in their relation to cultivation.

Drainage of the soil, S. GUÉRAND DE LAHARPE (*Jour. Agr. Prat., 1898, II, No. 50, pp. 846-849*).—The advantages of drainage are discussed in a popular way.

The relative sensitiveness of plants to acidity in soil, W. MAXWELL (*Landw. Vers. Stat., 50 (1898), No. 5-6, pp. 325-330*).—See E. S. R., 10, p. 128.

The inoculation of soils, A. HERTZOG (*Monatsber. Gesell. Förd. Wiss. Ackerbaues u. Künste Unter Elsass, 32 (1898), No. 7, pp. 439-467*).—Reports inoculation experiments with germ-containing soils and with pure cultures for nitrogen assimilation. Nitragin was successfully tested, and a trial of Alinit is contemplated.

Soil inoculation, TANCRÉ (*Landw. Wchnbl. Schleswig-Holstein, 48 (1898), No. 17, pp. 290-293*).

FERTILIZERS.

On the spreading and plowing under of barnyard manure, P. P. DEHÉRAIN (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 14, pp. 469-472; Ann. Agron., 24 (1898), No. 9, pp. 401-416; abs. in Rev. Sci., 4. ser., 10 (1898), No. 16, pp. 499, 500*).—For the purpose of throwing light upon the losses of nitrogen which manure undergoes when placed in heaps in the field and allowed to remain some time before spreading, the author placed 10 gm. of manure in a wide glass tube and passed a current of air through it, determining the amounts of carbonic acid and ammonia in the gases which passed off. Of the 32 mg. of ammoniacal nitrogen originally present in the sample, 23.9 mg. passed off under this treatment in 2 days. The evolution of ammonia gradually decreased after this period, but at the end of 26 days 31.8 mg. of ammoniacal nitrogen had escaped. The evolution of carbon dioxid, however, continued quite uniform throughout the experiment, 590.4 mg. of this gas being obtained.

In another series of experiments 100 gm. lots of manure, either without covering or covered with a layer of soil 7 to 8 cm. thick, were subjected to currents of normal air or air to which ozone had been added. In this case the passage of 1,583 liters of air containing ozone removed 43.3 per cent of the ammoniacal nitrogen originally present, and the normal air 48.7 per cent. In the case of the manure covered with soil the amount of ammoniacal nitrogen removed by normal air was only 3.9 per cent. Analysis showed that a considerable quantity of organic nitrogen was also removed in the free state by this treatment. In the case of the air containing ozone 19.3 per cent of the original nitrogen was lost in a free state; in the case of the normal air 15.2 per cent.

The manure lost in both forms 26.4 per cent of its original nitrogen when subjected to the action of air containing ozone; 23.2 per cent with normal air when the manure was uncovered, and 22.7 per cent with normal air when the manure was covered with soil. When the manure and air were sterilized the loss of nitrogen was very small, showing that the evolution of ammonia and free nitrogen was due to the action of micro-organisms and not the result of purely chemical changes.

The fertilizer control for 1897, W. A. WITHERS (*North Carolina Sta. Bul. 151, pp. 413–422*).—Fertilizer inspection in North Carolina is now under the control of the State department of agriculture. The station is employed to make the analyses, but the collection of samples and the publication of results is in the hands of the commissioner of agriculture. This bulletin, therefore, is confined to a summary of the work of the year, including data relating to the increase in the number of brands of fertilizers, extent and distribution of the fertilizer trade, valuation of fertilizers, and average composition of fertilizers on sale in North Carolina during several years (1890–1897).

"The number of brands registered for sale in North Carolina during 1897 is about the same as for 1896, but before that year the number increased very rapidly for each year since 1890, when there was a change from the brand tax to the tonnage tax." The number of brands offered for sale in the State in 1897 was 673 as against 666 the previous year. The consumption of fertilizers in the State has rapidly increased from year to year, amounting to about 208,000 tons, valued at about $5,000,000, in 1897. "The larger part of the fertilizers now used in the State were manufactured in North Carolina and Virginia."

The average composition of the principal classes of fertilizers used in the State during 1897 is shown in the following table:

Average composition of fertilizers sold in North Carolina in 1897.

	Available phosphoric acid.		Ammonia.		Potash.	
	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Acid phosphates	12.96	12.15				
Acid phosphates with potash	10.58	9.66			1.89	1.85
Ammoniated superphosphates with potash	9.01	8.01	2.85	2.56	2.43	2.15

The average composition of the fertilizers is about the same as in previous years except that there are slightly smaller percentages of ammonia and potash. "One out of every 4 of the usual fertilizers fell below the guaranty in some single ingredient and 1 out of 15 in its valuation."

Experiments on the action of phosphoric acid in bone meal and Valserine phosphate as compared with that of superphosphate and Thomas slag, P. LIECHTI (*Landw. Jahrb. Schweiz, 11 (1897), pp. 378–389*).—This is an account of comparative tests during 2 years (1896–1897) of the above phosphates on oats growing in galvanized-iron cylinders (20 cm. deep and 20 cm. in diameter) filled with a sandy humus soil containing a moderate supply of potash and phosphoric acid. The phosphatic materials used were bone ash superphosphate containing 16.3 per cent of water-soluble phosphoric acid in 1896 and 17.5 per cent in 1897; fine-ground Thomas slag containing 17.51 per cent total phosphoric acid and 15.68 per cent of citrate-soluble phosphoric acid, fine-ground Valserine phosphate containing 19.39 per cent total phosphoric acid and 1.44 per cent citrate-soluble phosphoric acid, raw bone meal containing 19.62 per cent total phosphoric acid and 4.32 per cent of nitrogen, fine-ground steamed bone meal containing 32.3 per cent phosphoric acid and 1.3 per cent nitrogen, and coarse steamed bone meal containing 32 per cent phosphoric acid and 1.4 per cent nitrogen. Each year phosphoric acid was applied in the different forms at the rate of 0.35 gm. per pot, or 111.46 kg. per hectare (99.3 lbs. per acre), together with supplementary applications of the necessary amounts of potash and nitrogen. The highest yields were obtained each year from the pots to which superphosphate and slag were applied. The pots receiving superphosphate yielded on the average in 1896 54.3 gm. of grain and 112.7 gm. of straw, containing 0.271 gm. of phosphoric acid; in 1897 the corresponding figures were 54, 83.3, and 0.2657. The pot receiving slag produced in 1896, 60.9 gm. of grain and 110.6 gm. of straw, containing 0.271 gm. of phosphoric acid; the corresponding figures in 1897 were 48.6, 76.1, and 0.292. It is thus seen that in case of the superphosphate and slag the yields were somewhat lower in 1897 than in 1896. There was a small relative increase in yield in the pots which had received insoluble phosphoric acid in the form of bone meal and mineral phosphate, but when the large amount of phosphoric acid actually applied in these cases is taken into account this increase is insignificant. The proportion of phosphoric acid applied which was recovered in the crops was as follows:

Proportion of phosphoric acid recovered in the crop.

	1896.	1897.
	Per cent.	*Per cent.*
Superphosphate	68	70
Thomas slag	68	73
Raw bone meal	0	0.04
Steamed bone meal (fine)	3	2
Steamed bone meal (coarse)	0	0

These results agree in general with those obtained by Wagner and Maercker; nevertheless the author concludes that such experiments do not furnish a reliable means of determining the relative value of different fertilizers.

How shall barnyard manure be managed, J. STOKLASA (*Wiener Landw. Ztg., 10 (1898), No. 40, p. 330; abs. in Centbl. Agr. Chem., 28 (1898), No. 1, p. 62*).—In the author's experiment decomposing liquid manure lost 50 per cent of its nitrogen in 30 days. This loss was not entirely prevented when the liquid was kept in deep pits unless these were hermetically sealed. From a test of various preservatives, including superphosphate and superphosphate gypsum, the author concludes that "bisulphate," a by-product from the manufacture of nitric acid, is the most effective and economical preservative material. Bisulphate contains 66 per cent of sulphuric acid in the form of acid sodium sulphate and frequently 2 per cent of potassium sulphate. Loss of nitrogen is completely prevented in manure treated with this substance to the extent of 0.5 per cent acidity. The liquid manure treated with this preservative must be applied to the soil alone. If mixed with the coarser manure a loss of nitrogen in the free state occurs.

Experiments on beets and barley with manure treated with superphosphate gypsum, A. OLSCHBAUER (*Deut. Landw. Presse, 25 (1898), No. 66; abs. in Centbl. Agr. Chem., 28 (1899), No. 1, p. 62*).—The author concludes from his experiments that superphosphate is not as valuable as a manure preservative as is usually assumed. The best results were obtained by the author with manure preserved with street dirt.

Farmyard manure, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Bul. 109, pp. 24*).—A popular discussion of this subject, based partly upon results of investigations at the experimental farm. The topics treated are constituents of plants, farmyard manure, solid and liquid excrements, influences which affect the composition of manure, care of farmyard manure, application of farmyard manure, and valuation of fertilizing constituents in manure.

Manures and composts, H. BOIRET (*Fumiers et composts. Annecy: Hérisson & Co., 1898, pp. 24*).

Fertilizer inspection, C. D. WOODS (*Maine Sta. Bul. 45, pp. 24*).—The results of analyses of 199 samples of commercial fertilizers are reported. The bulletin also includes a comparison of guarantees and analyses of samples collected by the station for 3 years, the chief provisions of the State fertilizer law, and a list of manufacturers complying with the law in 1898.

"A comparison of the results of the analyses of the samples collected by the station, with the percentages guaranteed by the manufacturers, shows that, as a rule, the fertilizers sold in the State are well up to the guaranty."

Commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Bul. 76, pp. 97–105*).—This bulletin calls attention to the main features of the State fertilizer law, gives directions for sampling fertilizers, discusses briefly the selection of fertilizers for different crops, and reports analyses of 48 samples of fertilizing materials.

Fertilizer analyses, R. C. KEDZIE (*Michigan Sta. Bul. 161, pp. 441–456*).—This bulletin gives an abstract of the State fertilizer law, with an explanation of its objects; a schedule of commercial prices, with notes on the valuation of fertilizers; an explanation of terms used in fertilizer analyses; a brief discussion of the principles underlying the use of fertilizers and of the sources from which nitrogen, phosphoric acid, and potash in fertilizers are derived, and tabulated valuations and analyses of 61 samples of fertilizing materials inspected during 1898.

Analyses of commercial fertilizers, H. J. WHEELER and B. L. HARTWELL (*Rhode Island Sta. Bul. 48, pp. 13–34*).—This bulletin deals with changes in the regulations regarding the inspection of fertilizers and cooperation in the work of fertilizer

inspection, and gives a schedule of trade values of fertilizing materials, text of the Rhode Island fertilizer law as amended March 1, 1898, a list of licensed fertilizers sampled by the chemist of the Rhode Island State Board of Agriculture, and analyses and valuation of 121 samples of fertilizing materials.

"In May, 1897, the fertilizer law which had been in operation in the State since April, 1892, was amended in such a way that the State Board of Agriculture, under whose authority the inspection had nominally been conducted, was released from any obligation to cause the work of the inspection to be done at the Rhode Island Agricultural Experiment Station, as heretofore."

This change did not prove satisfactory, and in March, 1898, the law was again amended so that the inspection of fertilizers was placed in the hands of the board of managers of the Rhode Island College of Agriculture and Mechanic Arts.

Analysis of licensed commercial fertilizers, F. W. WOLL (*Wisconsin Sta. Rpt. 1897, pp. 257–263*).—Notes on the commercial forms of the 3 essential elements of plant food and on valuation and tabulated analyses and valuations of 11 samples of fertilizers licensed in Wisconsin in 1897.

The different forms of lime for fertilizing purposes and their value and use, F. WAGNER (*Vrtljschr. Bayer. Landw. Rath., 3 (1898), No. 1, pp. 1–20*).—The different forms and sources of lime fertilizers are described with reference to Bavarian conditions.

Lime, nitrogen, and soda, H. J. WHEELER (*Rhode Island Sta. Bul. 47, pp. 10*).—A brief summary of the results of investigations by the station (E. S. R., 9, pp. 933, 935) on the use of lime, the relative crop-producing power of different forms of nitrogen on acid soils, and on soda as a substitute for potash.

The basis of the selling price of phosphatic slags, J. GRAFTIAU (*Bul. Assoc. Belge Chim., 12 (1898), No. 9, pp. 328–331*).—Discusses fineness and citrate-solubility as bases of valuation.

The drying of superphosphates, A. PETERMANN (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 25*).

The production and utilization of natural nitrates in agriculture, V. AYMÉ (*Rev. Sci. [Paris], 4. ser., 10 (1898), No. 26, p. 817*).—A general discussion of this subject.

Nitrogenous fertilizers—nitrate of soda and sulphate of ammonia, L. GRANDEAU (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 20*).

Statistics of production and consumption of nitrate of soda, MAIZIÈRES (*L'Engrais, 14 (1899), No. 2, pp. 35–37*).—The exports and consumption for a number of years past are stated. The exports from Chile in 1898 are stated to be 1,260,000 tons. Of this 140,000 tons was consumed in America and 1,040,000 tons in Europe.

FIELD CROPS.

Report of the department of agriculture (*Washington Sta. Rpt. 1896, pp. 5–26*).—The results of experiments with wheat, oats, corn, and forage plants, and in seeding pastures and permanent meadows are reported, and the work of the department is briefly described.

The experiments with wheat comprised variety tests, trials of different depths of plowing, and different rates and methods of seeding. Seventy-six varieties of winter wheat and 24 of spring wheat were tested. The following varieties of winter wheat, in the order given, averaged best for the seasons of 1895 and 1896: White Track, White Blue Stem, Seneca Chief, Thiess, Tasmania Red, Turkey, German Emperor, and Valley. The results of plowing at different depths showed that the yield increased with the depth up to 6 in., while beyond

the yield was materially reduced. In the seeding test the wheat was sown at rates varying from 2 to 5 pk. per acre. The largest yield was obtained from sowing 2 pk. per acre, the next largest from sowing 4½ and 5 pk., and the smallest from sowing 2½ pk. Drilling gave better results than broadcasting.

Plowing 6 in. deep for oats gave better results than plowing either 3 or 9 in. deep. Harrowing the soil 4 times before seeding instead of only once increased the yield per acre by 6 bu. On 9 plats oats were sown broadcast on the stubble and covered by means of a disk harrow, and then 3 of the plats were dragged twice and 3 dragged once and rolled. The results gave a difference of about 3 bu. per acre in favor of harrowing or harrowing and rolling. Of 13 varieties White Russian produced the best average yield for 1895 and 1896.

Twelve varieties of corn were tested to ascertain which kind reached the most advanced stage before frost. White dent gave the best results, reaching the proper stage for cutting before frost and yielding about 10 tons of silage per acre.

The grasses and forage plants grown at the station on experimental plats, permanent meadows, and in pastures are enumerated and a number of them briefly discussed.

Fiber flax investigations, F. A. HUNTLEY (*Washington Sta. Bul. 33, pp. 24, figs. 4, pl. 1*).—This bulletin reports culture and variety tests and retting experiments with flax, and describes in a popular way the various operations which enter into its culture and the preparation of the fiber. The results of the culture and variety tests are given in the following table:

Yield of flax from different varieties of seed.

	Variety of seed.	When sown.	Amount sown per acre.	Character of soil.	Yield of unthreshed straw per acre.	Yield of threshed straw per acre.	Yield of seed per acre.
			Pounds.		Pounds.	Pounds.	Pounds.
Plat 1	Riga	Mar. 28	90	Sandy loam	3,545	2,280	640
Plat 2	do	do	120	do	3,682	2,425	695
Plat 3	do	Apr. 17	150	do	4,267	2,986	661
Plat 4	do	do	120	do	3,760	2,608	638
Plat 5	Belgian	do	120	do	3,704	2,521	565
Plat 6	Riga	May 15	210	do			
Plat 7	Belgian	do	180	do	4,344	3,325	436
Plat 8	Riga	do	150	do	3,908	2,720	657
Plat 9	Belgian	do	120	do	4,016	2,921	664
Plat 10	Riga	do	210	Clay and sandy loam.			425
Plat 11	do	do	180	do	4,102	3,663	656
Plat 12	do	do	150	do			704
Plat 13	do	do	120	do	4,080	2,800	569

Retting was performed by submerging the straw placed in crates in a slow-flowing, clear stream, by anchoring the straw tied into bundles in a pool filled with water from the same stream and by placing it in special retting tanks. The water in the stream and pool maintained a temperature of about 51° F. and the retting required an average duration

of 14 days. In the retting tanks the temperature of the water was kept at 100° during the day and raised to 110° in the evening and allowed to fall from 5° to 15° during the night. These ranges of temperature produced the best results and the retting was usually completed in 110 hours. A higher temperature did not hasten the process and an average temperature of 20° lower prolonged it to about 145 hours. At 150° no retting took place.

A report on the culture of hemp in Europe (*U. S. Dept. Agr., Office of Fiber Investigations Rpt. 11, pp. 29, figs. 6*).—This includes a special consular report on the growth of hemp in Italy. The author reviews the hemp industry in this country and in France, discusses the kind of hemp grown in different countries, and gives directions for the various operations which enter into the culture of hemp and its preparation for market. Notes are given on the cultivation, drying, and cleaning of hemp in Italy.

The consular report discusses Italian hemp culture, describes the hemp plant, reports its chemical composition as determined by several authorities, and gives full directions for its culture and preparation. A plan of crop rotation is given in which the farm is divided into 18 fields and each year 6 fields grow alfalfa, 6 wheat, and 6 hemp. Notes are given on the construction of retting pools.

The influence of soil moisture and fertility on the development of the oat plant, M. TUCKER and C. VON SEELHORST (*Jour. Landw., 46 (1898), No. 1, pp. 53–63*).—These investigations on the development of the different parts of the oat plant were carried on as pot experiments. The pots were 33 cm. high and 24 cm. in diameter, and thus gave considerable space for root development. Each pot contained 17,130 gm. of dry soil and 712 plants were grown. The pots were divided into 3 series, according to the amount of moisture in the soil. At the beginning of the experiment, March 29, the amount of water furnished the soil was as follows: First series, 14.35 per cent; second series, 15.41 per cent; third series, 16.44 per cent, being 41.6, 45.2, and 48.8 per cent, respectively, of the water-holding capacity of the soil. May 18 the moisture was increased to 47.4 per cent of saturation in the second series and 53.2 per cent in the third, and on June 4, when the plants were heading, it was further increased in these series to 51.7 and 63.7 per cent of saturation, respectively. About 1 week later the water content in these series was increased to 56.1 and 70.6 per cent of saturation, respectively. Potash was applied in the form of potassium carbonate, phosphoric acid in the form of monocalcic phosphate, and nitrogen in the form of sodium nitrate in amounts shown in the table, which also summarizes the results.

Effects of different amounts of soil moisture and fertilizers on the development of the oat plant.

Plant food per pot.	First series.			Second series.			Third series.		
	Weight of roots.	Weight of grain and straw.	Ratio of roots to grain and straw.	Weight of roots.	Weight of grain and straw.	Ratio of roots to grain and straw.	Weight of roots.	Weight of grain and straw.	Ratio of roots to grain and straw.
	Grams.	*Grams.*		*Grams.*	*Grams.*		*Grams.*	*Grams.*	
Check	7.67	41.5	1:5.41	5.27	47.2	1: 8.95	7.28	68.5	1: 9.41
Potash, 1 gm.; phos. acid, 1 gm	10.78	67.5	1:6.26	8.27	83.6	1:10.10	8.40	99.5	1:11.84
Potash, 1 gm.; phos. acid, 1 gm.; nitrogen, 1 gm	10.07	68.5	1:6.80	7.11	93.4	1:13.13	7.62	119.5	1:15.68
Potash, 1 gm.; phos. acid, 1 gm.; nitrogen, 2 gm	10.97	68.5	1:6.24	8.51	94.0	1:11.04	9.10	135.0	1:14.83
Potash, 1 gm.; nitrogen, 1 gm	5.69	38.5	1: 6.75	4.38	40.0	1: 9.13	8.12	63.5	1: 7.82
Potash, 1 gm.; nitrogen, 1 gm.; phos. acid, 2 gm	10.68	79.2	1:7.41	8.95	108.0	1:12.07	8.60	127.5	1:14.82
Phos. acid, 1 gm.; nitrogen, 1 gm	10.66	75.5	1:7.08	6.65	101.5	1:15.26	9.03	126.0	1:13.95
Phos. acid, 1 gm.; nitrogen, 1 gm.; potash, 2 gm	11.50	74.0	1:6.43	8.64	99.5	1:11.51	7.27	117.5	1:16.16

Most of the plants were ripe August 9, but the plants grown in pots which received no fertilizer and those which received only potash and nitrogen were not ripe until August 16. In general the increase in soil moisture increased the development of the parts of the plant above ground and decreased the development of the roots. The fact that the soil with the lowest moisture content favored root development is considered due to hydrotropism. The plants which received no phosphoric acid showed the least root development and gave the smallest yields. The authors conclude that increase in soil moisture diminishes root development and that fertilizing increases it, but that these 2 factors acting in conjunction increase the yield.

Experiments with oats, J. F. DUGGAR (*Alabama Sta. Bul. 95, pp. 157–180*).—The experiments with oats here reported consisted of variety and fertilizer tests and investigations on the time of sowing, rotations, and the prevention of smut.

Five varieties of oats imported from France were compared with varieties obtained from seedsmen and Red Rust Proof oats grown at the station. All varieties except one were sown at the rate of 44 lbs. per acre on November 16, 1896, and all plats were $\frac{1}{11}$ of an acre in size. The foreign varieties were evidently spring oats, and only one, Gray Winter, proved hardy, and has for 2 years ranked well among the varieties tested. Virginia Gray and Red Rust Proof, both American varieties, produced the best yields of grain. Seed from the varieties tested in 1896 and of a few additional varieties was sown November 6, 1897. In the same field spring and fall strains of Red Rust Proof oats were tested. Red Rust Proof, Beardless, Hatchett Black, and Gray Winter, in the order given, produced the most grain. Red Rust Proof yielded 30.8 and Gray Winter 19.5. There was practically no difference between the spring and fall strains of Red Rust Proof oats, which

is considered due to a mild winter. Of 7 varieties sown February 17, 1898, Burt, May, and Red Rust Proof were most productive, yielding 41.4, 35.9, and 30.6 bu. per acre, respectively. The yield of Red Rust Proof is the average of 2 plats. The varieties grown as Burt and May appeared to be identical. The winter varieties, Virginia Gray, Meyer Turf, Black Belgian Winter, and Black Mesdag, failed. The Black Belgian Winter oats produced no grain at all. In the experience of the station Red Rust Proof is the only general purpose variety for that locality, although Meyer Turf, Virginia Gray, Delaware Winter, and Gray Winter were found to be hardier. Burt ripened 1 to 2 weeks before Red Rust Proof sown on the same date in the spring and only 1 to 3 days later when this variety was sown in the fall. Red Rust Proof matured 12 to 19 days earlier when sown in November than when sown in February. Meyer Turf, Virginia Gray, and Gray Winter matured 10 to 12 days later than Red Rust Proof, and Hatchett Black matured between Red Rust Proof and Meyer Turf.

Three experiments were made on fall and spring sowings with Red Rust Proof oats, the average results showed that oats sown in November yielded 9.8 bu. of grain and 531 lbs. of straw per acre more than oats sown in February and March. The average date of harvesting the spring-sown crop was June 12, and of the fall-sown crop May 26.

Oats grown after cowpeas, the vines having been plowed under, produced 10.4 bu. of grain and 229 lbs. of straw per acre more than oats grown after German millet plowed under as a fertilizer. On a series of 6 plats velvet bean vines, velvet bean stubble, cowpea vines, cowpea stubble, crab grass and weeds, and German millet stubble were plowed under. The plats were then fertilized with 220 lbs. per acre of acid phosphate and 44 lbs. muriate of potash and sown to oats in the fall. The average yield of oats per acre was 33.6 bu. after velvet beans, 31.6 bu. after cowpeas, and 8.4 bu. after crab grass and weeds and German millet. There was a gain of 24.2 bu. of oats and nearly $\frac{3}{4}$ of a ton of straw per acre as a result of growing leguminous instead of nonleguminous crops during the preceding season. The plats on which the velvet bean and cowpea stubble had been plowed under produced better yields than those on which the vines were plowed under. This is believed to be due to the fact that the vines were not properly buried by the plow and that the stubble ground made a better seed bed. Three series of experiments, 2 with fall-sown oats, and 1 with spring oats were made to determine the best time of applying nitrate of soda as a top-dressing. In all cases the application was more effective when applied in March than when used in the latter part of April.

Four plats were sown to oats after having been fertilized with complete fertilizer and 2 of the plats received in addition 600 lbs. slaked lime per acre. There was a difference of 12.9 bu. per acre in the yields in favor of the limed plats. One thousand pounds of quicklime per acre, applied as a top-dressing after being slaked, effected no gain on

poor sandy soil. A cooperative fertilizer experiment with oats sown in February failed on account of dry weather. The plats receiving kainit offered the greatest resistance to the drought and produced the largest yields.

Equal quantities of seed oats by weight were sown on 2 plats of poor sandy soil. The seed for 1 plat had been scalded in water at 130 to 135° F. for 10 minutes. The untreated seed yielded 13.1 bu. and the treated seed 14.2 bu. per acre. The heads on both plats were counted and it was found that on the plat with untreated seed 5.9 per cent of the heads were destroyed by smut and no smut was found on the other plat. Complete directions are given for the Jensen or hot-water treatment for the prevention of smut.

The influence of depth of planting on growth and productiveness of potatoes, E. S. Goff (*Wisconsin Sta. Rpt. 1897, pp. 306, 307*).—An experiment was conducted to determine the influence of depth of planting on productiveness, size, and manner of growth of potatoes. Twenty-five hills of Burbank potatoes were planted May 22, at different depths. The seed tubers were planted whole, one in a place, 2 ft. apart, in rows 3½ ft. apart. Ordinary cultivation was given, and the crop was harvested October 13 to 14. The results obtained are given in the following table:

Results of planting potatoes at different depths.

Depth planted.	Hills germinating.	Tubers protruding from soil.	Average number of tubers per hill.	Average weight of tubers per hill.	Average depth to deepest tubers.
	Per cent.	*Per cent.*		*Pound.*	*Inches.*
2 inches	100	8.4	6.6	0.58	2½
4 inches	96	.8	5.4	.62	3½
6 inches	88	.0	3.2	.35	5

Growing rye after potatoes, M. Fischer (*Fühling's Landw. Ztg., 47 (1898), No. 18, pp. 702–706*).—It is stated that rye grown after potatoes frequently gives an unsatisfactory yield, which is believed to be due to the fact that a hoed crop like potatoes leaves the soil too loose for the rye plant. To ascertain whether this belief is correct rye was grown on 10 plats on which fertilizer experiments with potatoes had been made the previous year. Two of these plats were fertilized with nitrate of soda, 2 with lime, 3 with barnyard manure, 1 with Thomas slag, and 2 receiving no fertilizer. The best yields were obtained from the plats which were fertilized with nitrate of soda. From the results obtained it is concluded that the mechanical condition of the soil is not the direct cause of the unsatisfactory yields of rye when grown after potatoes, but that the potato, especially when it remains in a growing condition nearly to the time of harvesting, uses most of the available nitrogen and leaves an insufficient supply to enable the rye to make a good growth.

The growth and use of the rape crop, J. A. CRAIG (*Wisconsin Sta. Rpt. 1897, pp. 56–71, figs. 3*).—This article gives complete and detailed instructions for the culture and use of the rape crop and reports the results of cutting rape for soiling purposes. The limits to the growth and use of rape are pointed out, the different varieties described, and directions given for the seeding, cultivation, and use of the crop.

A half-acre plat of rape was used for soiling purposes and furnished feed for one month beginning August 16. The rape was cut close to the ground and owing to the lateness of the season did not make a heavy second growth. A number of trials were made with different methods of cutting and twisting the plants. Results are given in the following table:

Results of different methods of twisting and cutting rape.

Method of treatment.	Yield.			Total.
	Aug. 29.	Sept. 29.	Nov. 8.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Five rows twisted 8 in. from ground	253	157¼	159½	569¾
Five rows cut 8 in. from ground	273	206½	153½	633
Five rows cut 4 in. from ground	293	Not cut.	431½	724½
Five rows cut close to ground	343	Not cut.	296	639

In this test cutting rape 4 in. from the ground gave the best results. Cultivation immediately after each cutting is recommended.

Another experiment was made to determine the best time for cutting the crop. The following results were obtained:

Results of cutting rape at different times.

	First cutting.		Second cutting.		Third cutting.		Total.
	Date.	Yield.	Date.	Yield.	Date.	Yield.	
		Pounds.		*Pounds.*		*Pounds.*	*Pounds.*
Plat 1	June 25–July 1	3,062	Aug. 6–12	2,389½	Oct. 22–28	2,218	7,669½
Plat 2	July 2–8	4,081½	Aug. 13–19	1,708	Oct. 29–Nov. 4.	1,987	7,776½
Plat 3	July 9–15	2,939	Aug. 20–26	1,443	Too light for cutting.		4,382

The author concludes that rape sown as early as possible, cut 4 in. from the ground, and cultivated frequently, will furnish 3 cuttings during the summer and fall.

Special report on the beet-sugar industry in the United States, 1897 (*U. S. Dept. Agr., Special Report on the Beet-sugar Industry in the U. S., 1897, pp. 240, figs. 2, maps 2*).—This publication is a comprehensive report of the conditions of sugar-beet culture and beet-sugar manufacture in the United States in 1897. The results of analytical and experimental work, and statistics concerning the production of beet sugar and the cost of producing sugar beets are given.

Report of the chemist, H. W. Wiley (pp. 1–160).—This report gives a bibliography of Department publications on the sugar-beet industry, reviews in general the work of the Department and the experiment stations with sugar beets, and reports the results of analyses made in the chemical laboratory of the Department and at different experiment stations. The climatic conditions are considered in general and the probable areas suited to beet culture are shown on a map. The average rainfall for the months of April to October, inclusive, at different places in 11 States east of the Mississippi are tabulated, and the conditions of temperature and precipitation of particular localities throughout the country are noted. The following table gives the results of analyses of beets for States from which 10 or more samples were obtained:

Composition of sugar beets grown in different States, 1897.

State.	Number of samples.	Number of counties represented.	Average results.			Maxima.		Minima.	
			Weight.	Sugar in the beet.	Purity coefficient.	Sugar in the beet.	Purity coefficient.	Sugar in the beet.	Purity coefficient.
			Ounces.	*Per ct.*		*Per ct.*		*Per ct.*	
Colorado	174	26	20	13.6	76.7	20.9	88.1	4.1	63.4
Illinois	32	19	17	13.1	75.5	21.2	86.8	8.3	67.7
Indiana	103	17	14	13.1	78.9	19.1	88.4	7.8	71.3
Iowa	130	38	18	13.3	73.7	19.0	87.4	6.1	65.9
Kansas	41	12	27	11.4	73.8	17.8	85.3	6.6	65.7
Maryland	29	9	19	11.4	79.1	15.7	85.7	3.2	66.8
Michigan	450	22	22	14.7	81.1	20.2	91.0	4.1	67.9
Minnesota	49	15	24	11.0	79.2	17.7	86.3	6.9	67.5
Missouri	324	90	20	11.7	73.5	19.8	86.1	3.6	57.8
Nebraska	13	8	29	12.9	76.9	17.3	80.2	8.5	73.0
Nevada	21	6	18	18.3	81.4	20.8	85.5	16.0	75.4
New Jersey	31	8	16	14.2	81.4	18.7	90.1	8.6	67.8
New York	225	27	21	15.0	82.4	22.6	90.6	9.0	70.8
Ohio	68	32	22	13.8	79.1	18.7	89.9	5.6	63.1
Pennsylvania	59	12	18	13.8	79.5	19.6	89.2	7.1	65.0
South Carolina	13	8	17	9.9	79.9	13.7	....	3.8	....
Tennessee	17	5	11	10.8	71.9	14.9	74.1	5.6	69.8
Texas	11	8	22	12.6	76.5	14.7	80.1	8.8	72.3
Utah	35	7	20	14.3	81.1	20.2	90.5	9.1	70.6
Virginia	34	21	21	11.6	76.2	15.5	83.3	5.6	65.4
Washington	34	10	27	13.7	80.7	19.9	89.7	5.8	67.0
West Virginia	14	5	19	15.4	80.4	18.9	88.8	11.9	69.1
Wisconsin	42	8	15	15.8	83.3	19.5	88.2	11.5	71.4
Wyoming	34	9	19	17.2	82.3	24.3	92.1	9.1	70.2

The analytical data presented in the table are elucidated by a brief discussion of them for each State, supplemented by a summary of the results obtained by the experiment stations in the different States. Suggestions based on some of the data obtained are made on the influence of temperature on the quality of sugar beets, and in this connection the significance of the theoretical thermal belt suitable to the growing of sugar beets is pointed out. The use of sugar beets and beet pulp as cattle feed is discussed, with a review of feeding experiments in this line, and the results of analyses of diffusion pulp are quoted. Data collected in previous years from cultural tests of sugar beets in various States are summarized in tables.

The investigations in seed production carried on under the direction of the Department of Agriculture at the New York State, Indiana, Wisconsin, Iowa, Kentucky, and Tennessee stations are described for each

station. A number of varieties of high-grade beets were grown at each station and analyzed, and samples were also sent to the Department laboratory for analysis. The most satisfactory results were obtained at the New York State Station. The classification of the beets of each variety based on the sugar content is given in the following table:

Classification of sugar beets of different varieties grown at the New York Station at Geneva.

Variety.	Number of beets having contents of sugar from—				Maximum polarizations of individual beets.	Minimum polarizations of individual beets.
	15 to 16 per cent.	16 to 17 per cent.	17 to 18 per cent.	18 per cent and above.	Per cent.	Per cent.
White Improved Imperial Elite	65	20	23	4	19.6	11.6
Vilmorin La Plus Riche	7	16	32	94	23.4	13.4
Vilmorin Improved, Schuyler Seed	4	8	5	3	18.8	12.4
Demesmay	11	14	5	40	22	9.6
Vilmorin Improved Elite (Dippe Bros.)	1	4	5	47	21.6	10.6
High Grade Commercial Kleinwanzlebener	19	30	64	107	22	13.6
Kleinwanzlebener (Holland)	0	1	9	50	22.2	18.4
Kleinwanzlebener Elite	6	15	24	165	22	14.6

The work of the experiment stations reviewed in this publication has been abstracted from the bulletins of the respective stations.

Report of the special agent, C. F. Saylor (pp. 161–240).—This is a comprehensive presentation of the conditions of the sugar-beet industry in the United States in 1897, the methods in vogue to aid its growth, and the natural resources and commercial advantages and opportunities which exist and tend to make it a profitable field for labor and capital. The author discusses in a popular way the experiments in growing sugar beets in 1897, the region adapted to the culture of the sugar beet, and the factory requirements with reference to the quality of the beets and the materials used in the manufacture of beet sugar. General suggestions are given on the various operations connected with the growing of sugar beets, and statistics are presented on the consumption of sugar in the United States and leading European countries and the beet-sugar industry in Germany for the years 1892 to 1895. The experiences and observations of factory officials and operators and successful sugar-beet growers, obtained through a series of questions concerning their work, are reported. The cost of growing sugar beets and the cost and running expenses of factories are estimated in detail. Notes are given on the by-products of beet-sugar manufacture.

A soil study of sugar beets, W. P. HEADDEN (*Colorado Sta. Bul. 46, pp. 63*).—This bulletin presents the results of a study of the effects of alkali on the composition of the sugar beet. The experiments were made to determine the effects of the accumulation of various salts on or near the surface of low or poorly drained lands under irrigation. The soil on which they were conducted varies from a gravelly loam to a fine alluvium with a calcareous subsoil, being very retentive of water

to a depth of 5½ ft., where it is underlaid by a stratum of clay practically impervious to the water which fills the gravel below. The salts mentioned as present in the soil are sodium chlorid, sodium carbonate, sodium sulphate, magnesium sulphate, and calcium sulphate. Check plats were located on good soil presumably free from alkali.

After irrigation or other favorable conditions incrustations of soluble salts ½ in. in thickness formed on the surface of portions of the plat on which the sugar beets were grown. The ground was plowed and subsoiled to a depth of 14 in., and the seeds were drilled in rows 2 ft. apart. From the analyses of the beets produced the author concludes that the effect of the alkali upon the sugar content was not detrimental. Beets were analyzed each week, from September 2 to October 13, to test the increase in sugar content during the ripening period. The most marked increase was found to have occurred from October 6 to 13. "This change which we speak of as the maturing of the beets makes a difference of from 2 to 3 per cent." Beets left in the ground and protected against severe freezing did not show a loss in sugar or in weight.

Analyses were made to determine the distribution of sugar in the beets and the effects of freezing and drying. It was found that the difference in the average percentage of sugar in the thirds of beets, taken by weight, was less than 2 per cent in favor of the middle and lower thirds, but the coefficient of purity was practically the same throughout. The percentage of sugar in the crown was about 1 per cent less than in the rest of the beet, while the coefficient of purity was but little lower. Freezing without subsequent thawing did not seem to affect the quality of the beet, while drying increased the percentage of sugar, but was accompanied by an actual loss of sugar. The loss in drying amounted to about 5 per cent during the first 24 hours, but it fell to about 2 per cent at the end of 5 days, and then remained practically constant for the next 12.

It was shown in these experiments that the weight of the leaves was equal to about 87 per cent of the weight of the roots. The weight of the leaves did not increase materially during the last 6 weeks of the growing season, but the weight of the root increased by 64 per cent of its weight at the beginning of the period, September 2, or 39 per cent of the weight of the mature beet. The presence of alkali slightly increased the weight of the leaves but had no marked influence on the maturing of the crop. From the results of numerous analyses of the beets, which are given in tables, it was found that the presence of alkali had had no influence on the amount of dry matter, and that the dry matter other than sugar decreased as the formation of sugar in the beet progressed. The dry matter of the upper third of the beet was a little higher than in the other two-thirds.

As shown by the ordinary fodder analysis, the presence of alkali increases the percentage of ash and crude protein and decreases the percentage of nitrogen-free extract. The alkali had a greater effect upon the composition of the beet than upon that of the leaves. The

mature beet as grown in these experiments contained about 1.1 per cent of ash and the leaves a little more than twice as much. The effect of alkali was to increase the percentage of ash in the roots by about 2 per cent of the dry matter. The upper third of the beets was found to contain a higher percentage of dry matter than the other two-thirds, but the dry matter of the lower third was richer in ash than that of either of the other two. The author states that he failed to find any relation between the percentage of sugar and the percentage or composition of the ash.

The character of the soil did not seem to affect the composition of the ash which is believed to be very constant; the analyses show the following approximate percentages: Sulphuric acid, 3.5; phosphoric acid, 7 to 9; alkalies, 48 to 52; lime, 2 to 3; magnesia, 6; chlorin, 11.50 to 14.50; carbon dioxid, about 15. The ash of the leaves contained from one-third to one-fourth as much phosphoric acid, from 2 to 3 times as much chlorin, a little more lime, about one half more magnesia, and about $\frac{1}{13}$ less alkalis than the ash of the roots.

Four series of tests were made to determine the effect of some of the salts found in the soil on the germination of different varieties of beet seed. The salts were used separately and in conjunction, in quantities varying from 0.01 to 1 per cent of the air-dried soil in which the seed was germinated. The first series of tests was made with sodium carbonate, the second with sodium sulphate, the third with a mixture of these two, and a fourth with magnesium sulphate. Seeds were germinated in ordinary glass tumblers. It was found that the beet seed germinated freely in soil containing 0.1 per cent of sodium carbonate, but the young plants were injured in soil containing only 0.05 per cent. The influence of sodium sulphate was less marked, but it proved injurious when present in larger quantities than 0.8 per cent of the air-dried soil. When both of these salts were present in equal quantities, the action of the carbonate was not influenced perceptibly. One per cent of magnesium sulphate retarded germination, and the presence of sodium salts hastened it. Of the varieties tested in these experiments Vilmorin seemed to be most sensitive to the action of the alkali.

New Mexico sugar beets, 1897, A. GOSS (*New Mexico Sta. Bul. 26, pp. 71–113, pl. 4*).—This bulletin presents the results of culture experiments with sugar beets, carried on at the station and in 14 of the 18 counties of the Territory. Popular directions are given for the various operations in sugar-beet culture, including irrigation, and statistics concerning the sugar industry are tabulated.

The average results at the station with different varieties of beets harvested at different dates were as follows: Beets harvested September 15 averaged 1.22 lbs. in weight, 11.03 per cent sugar in the juice, and 78.8 in purity; beets harvested October 14, 1.53 lbs. in weight, 12.47 per cent sugar in the juice, and 79.4 purity; and the beets harvested November 16, 1.71 lbs. in weight, 13.89 per cent sugar in the juice, and 77.2 purity.

The beets in the samples from the 14 counties averaged 1.83 lbs. in weight, 14.46 and 13.74 per cent sugar in the juice and the beet, respectively, and 77.9 in purity. Fourteen samples from San Juan County gave an average of 16.46 per cent of sugar in the juice and 81.3 purity, the beets averaging 2 lbs. in weight. The samples from Taos County showed an average sugar content in the juice of 17.42, a purity of 80.7, and an average weight per beet of 1.17 lbs.

On a series of plats at the station beets were harvested and analyzed each month from September to March, inclusive. "The beets did not attain their full sugar content until the middle of November, and . . . The sugar content remained practically constant from that time until the middle of February. In March the sugar had begun to decrease, due, doubtless, to the fact that the beets had started to grow."

Analyses were made of beets varying in weight from ¼ to 9¾ lbs. It was found in general that the sugar content and the purity decreased as the size of the beets increased, ranging from 16.2 per cent sugar and 82.2 purity in the ¼-lb. beets to 8.8 per cent sugar and 66.2 purity in the 9¾-lb. beets.

Fifty well-formed beets, dug November 18, were divided into 5 equal lots, kept at an ordinary room temperature and analyzed at different periods, to study the effect of drying. The results are given in the following table:

Sugar content and purity of sugar beets as affected by drying.

Analyzed after harvesting.	Average weight per beet in fresh sample.	Sugar in juice.	Purity.	Decrease in water content.	Increase in sugar content.
	Pounds.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
0 days	1.44	14.3	84.1	0.	0.
6 days	1.56	15.9	79.9	9.0	11.2
15 days	1.52	18.5	81.1	21.7	22.7
21 days	1.51	20.0	82.3	25.9	28.5
28 days	1.46	21.5	81.8	33.7	33.5

It is stated that 15 tons of sugar beets per acre remove from the land 105 lbs. of potash, 30 lbs. of phosphoric acid, and 60 lbs. of nitrogen; and that 30 bushels of wheat per acre remove in the grain and straw 28 lbs. of potash, 23 lbs. of phosphoric acid, and 45 lbs. of nitrogen.

The importance of the right amount and the right distribution of water in crop production, F. H. KING (*Wisconsin Sta. Rpt. 1897, pp. 216–231, figs. 9*).—Experiments with supplemental irrigation at the station during 3 years have shown that as a rule the natural supply of water (rainfall) is not sufficient for the maximum yields of the ordinary farm crops. This article summarizes the results of experiments along this line on barley followed by clover, potatoes, and corn.

Barley.—In the experiments with barley in 1897, the rainfall of 5.81 in. was supplemented by 4.16 in. of irrigation water (2.32 in. applied June 17 and 1.84 in. applied July 9). The results indicate that the

amount and distribution of rainfall during this season was such as to give nearly the maximum yield of barley; so that there was little difference between the yields on the irrigated and unirrigated plats. The clover following the barley, however, was decidedly benefited by irrigation. This crop received 3 additional irrigations (July 23, August 20, and September 8), amounting in the aggregate to 12.84 in.

The result of these 3 irrigations was a second crop of barley and clover mixed, which was cut and put into the silo September 22, weighing 6,552 lbs., from 25,330 sq. ft., or 1.36 tons of hay per acre, containing 15 per cent of water. With the rainfall of this year this crop would have been nothing, and there would have been a much poorer stand of clover.

Clover.—The rainfall during the season of growth of the clover was 9.44 in. This was supplemented by 5.85 in. of irrigation water, divided between May 18, June 1, July 7, and July 22, making the total amount of water which the clover crop received 15.29 in. The total yield of hay in 1897 was 4.43 tons, the second crop being 1.8 tons. "It is safe to say that with plenty of water, either as rain or irrigation, both the first and second crops of hay may easily be made double what is usually realized."

Potatoes.—In these experiments Rural New Yorker potatoes were planted in rows 30 in. apart, with hills 15 in. apart, and Burbank potatoes were planted 30 in. apart both ways. Alternate groups of 6 rows were irrigated in each case, the Rural New Yorkers receiving 8.25 in. of water July 20, 21, August 19, and September 8; the Burbanks 6.79 in. on the same dates, making, with the rainfall of 11.49 in., 19.74 and 18.28 in. respectively of total water. The gain due to irrigation was 126.2 bu. per acre in case of the Rural New Yorker and 117.1 bu. in the case of the Burbanks. The results also show that water applied to one side of the row (half irrigation) "does not produce the maximum results, the mean loss by half irrigation being for the 2 years and 4 sets of trials 70.3 bu. of merchantable potatoes per acre, while the mean gain for full irrigation over no irrigation was 105.8 bu. per acre. "In the case of the rows of potatoes next to the half irrigated ones the mean yield was increased by the watering 7.9 bu. per acre. It is plain, therefore, from these two years' work that plenty of water at the right time is indispensable to the largest yields of potatoes."

It was observed that tip burn did less injury on the irrigated plats than on those which were not irrigated.

Corn.—Plats which have not been fertilized since 1894 have been planted continuously from 1894 to 1897, one-half in flint corn, the other half in dent corn. The rainfall, which ranged from 4.48 in. in 1895 to 15.02 in. in 1896, was supplemented by irrigation water amounting to from 5.7 in. in 1897 to 26.6 in. in 1895. The yield was invariably increased by the supplemental irrigation, showing that in none of these years were the amount and distribution of rainfall such as to produce the maximum yield of corn. In these experiments the effect of the rate

of planting was also studied. Corn was planted in rows 44 in. apart and in hills 15 in. apart at rates of 4, 3, 2, and 1 stalk to the hill.

"The maximum yield of feed per acre was secured with 3 stalks in a hill when the natural rainfall fed the crop, and also when this was supplemented with a little more than 7 in. of water by irrigation. So, too, the smallest yield of dry matter per acre was secured in every one of the 4 cases where the 1 stalk was planted every 15 in. with rows 44 in. apart (E. S. R., 9, p. 595).

"When the yields of shelled corn per acre are compared it will be seen that a somewhat different relation holds, the largest amount with the white dent being produced where there were but 2 stalks every 15 in.; but with the smaller variety of Pride of the North dent the largest yield of corn coincided with the largest yield of dry substance where irrigation was practiced, but where the natural rainfall produced the crop the largest amount of shelled corn was associated with the thinnest seeding, and it is a noteworthy fact that this yield is almost as large as where the water was applied, showing that with so thin a stand there was nearly water enough in the season's rainfall for maximum yields."

Analyses of the grain indicate that the thinnest seeded corn was somewhat the richest in nitrogen.

Cost of irrigation in 1897.—With an ordinary farm engine using coal at $5 per ton, 28.87 acre-in. of water per ton of coal was raised 26 ft. through a 6-in. pipe, at a cost of 17.32 cts. per acre-inch. With a 2½-horsepower gas engine, using gas costing $1.25 per thousand feet, the cost of raising the water 12.85 ft. was 15.75 cts. per acre-inch. "These results make it appear safe to say that water can be pumped to a height of 26 ft. under conditions similar to ours at a cost for fuel not to exceed 20 cts. per acre-inch."

Water used by crops in Wisconsin.—This is a continuation of previous investigations on this subject (E. S. R., 8, p. 293), both in the plant house and in the field. The investigations have included experiments with corn, oats, clover, and potatoes. The results are summarized in the following table:

Water used by different crops in Wisconsin.

Crop.	Number of trials.	Water required per ton of dry matter.
		Acre-inches.
Corn in the field	8	2.433
Corn in plant house	44	2.386
Difference		.047
Oats in the field	8	5.011
Oats in plant house	12	4.535
Difference		.476
Clover in the field	24	5.345
Clover in plant house	22	5.005
Difference		.340
Potatoes in the field	8	4.283
Potatoes in plant house	6	2.618
Difference		1.665

"It will be seen that, except in the case of the potatoes, the difference between the amount of water used in the field and in the plant house is relatively small. In the case of the potatoes the large difference is due to the fact that in the field trials the plants did not develop perfectly."

The completeness with which the water is utilized by crops in the field and in the plant house is briefly discussed.

Agriculture in Russia, C. COURRIÈRE (*Jour. Agr. Prat., 1899, I, No. 1, pp. 22–24*).—A note on the conditions of Russian agriculture.

Woburn Experimental Farm: Tabulated results of experiments, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), pt. 4, No. 36, pp. 678–726*).—The results of rotation tests and experiments on the continuous growth of wheat and barley for the years 1877 to 1897, inclusive, are given in tables and the plan of the experiments is briefly outlined. An account of some of this work has been noted from a previous volume of this publication (E. S. R., 9, p. 199).

Reports of the department of agriculture and horticulture, F. A. HUNTLEY (*Idaho Sta. Bul. 15, pp. 145–149*).—This report briefly outlines the work performed in the line of agriculture and horticulture by the station in 1897 and presents plans for the work during the season of 1898. The work consists mainly of variety, and culture tests of grain, grasses, and garden crops.

The castor-oil plant (*Jour. Jamaica Agr. Soc., 2 (1898), No. 12, pp. 528–530*).—Notes on the culture of the plant and the preparation of the seeds for the oil mill.

The culture of coffee in Mexico, H. A. TURNBULL (*Bol. Repub. Mexicano, 2 (1898), pp. 161–169*).—A popular article describing the coffee industry of Mexico.

A few hints on maize growing, H. A. TARDENT (*Queensland Agr. Jour., 3 (1898), No. 6, pp. 411–420, pls. 2, figs. 4*).—Notes are given on the preparation of the land, the selection of seed, and the planting, harvesting, storing, and marketing of the crop.

Growing and breeding oats, A. KIRSCHE (*Deut. Landw. Presse, 26 (1899), No. 6, pp. 45, 46, figs. 2*).—A report on experiments in breeding oats, with measurements and weights of the plants obtained.

The potato, A. W. SUTTON (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), pt. 4, pp. 581–653, figs. 58*).—This illustrated monograph discusses the natural distribution of the potato and its introduction into Europe; deterioration of cultivated varieties; the diseases which attack the plant, and the means to prevent them; the manuring of the crop, its composition and comparative food value, and the practice of modern potato culture. The habitat of other tuber-bearing species of Solanum is discussed and varieties of potatoes in different parts of the world are described. The different practices in potato culture in various parts of England, Scotland, and in the Channel Islands are outlined.

Experiments with potatoes, C. FRUWIRTH (*Fühling's Landw. Ztg., 47 (1898), No. 24, pp. 921–923*).—This article reports the results of variety tests, distance experiments, tests of using whole tubers or different-sized cuttings for seed, and a trial of treating seed tubers for the prevention of scab.

New plants for field culture, A. DUBOIS (*Jour. Agr. Prat., 1899, I, No. 3, pp. 90–92, figs. 3*).—Notes on a new variety of potatoes, a new hybrid wheat, and cañaigre.

Experiments with sugar beets in 1897, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Bul. 52, pp. 165, figs. 2, maps 2*).—A reprint from the special report on the beet-sugar industry in the United States, 1897 (see p. 740).

The culture of beets and beet seed, P. DOERSTLING (*Fühling's Landw. Ztg., 47 (1898), No. 22, pp. 857, 858*).—A popular note.

The velvet bean (*Florida Agr., 25 (1898), No. 13, p. 196*).—Notes are given on the value of the velvet bean as a soil renovator and forage crop, with directions for its culture.

Florida velvet bean (*Jour. Jamaica Agr. Soc., 3 (1899), No. 1, pp. 14–16*).—A general discussion of the value of the velvet bean and its botanical relationship.

Varieties of winter cereals, TRIBONDEAU (*Jour. Agr.* [*Paris*], *1898, II, No. 1675, pp. 1026–1030*).—Brief descriptions are given of a number of different varieties of winter grains. The results of several fertilizer experiments in connection with the tests of these varieties are reported.

Report on experiments carried on at Kloster Hadmersleben in 1897–98 with different sport varieties of grain, F. HEINE (*Deut. Landw. Presse, 25* (*1898*), *No. 81, p. 868*).

Notes on the culture of wheat (*Queensland Agr. Jour., 3* (*1898*), *No. 6, pp. 399–410, pls. 3*).—Notes on seeding, harvesting, and stacking wheat. Descriptions of a number of varieties of wheat and barley are given.

Natural cross fertilization of oats and "change of seed," T. JAMIESON (*Proc. Agr. Research Assoc.* [*Scotland*], *1897, pp. 31–50, fig. 1*).—This article is a discussion of the practice of changing seed and a report on experiments in natural cross fertilization of oats. The terms high breeding, cross breeding, mongrels, and natural and artificial crossing are defined. From the results of the experiments the author concludes that oat plants cross freely when grown side by side, that the wind is a sufficiently effective pollen carrier for this purpose, that naturally crossed seeds produce heavier plants than seeds that have not been so crossed, and that crossing may be accomplished on a large scale by mixing the seeds of 2 varieties or differentiated strains and then sowing the resulting seeds the following year.

Cross breeding of wheat (*Queensland Agr. Jour., 3* (*1898*), *No. 5, pp. 335–338*).—Notes on the objects and methods of cross breeding wheats with regard to the requirements of good milling wheats.

The wheat-growing capacity of the United States, E. ATKINSON (*Pop. Sci. Mo., 54* (*1898*), *No. 2, pp. 145–162*).

The mineral requirements of grain and the fertilizer applications in spring, L. GRANDEAU (*Jour. Agr. Prat., 1899, I, No. 1, pp. 12–14*).—A popular article discussing the utilization of plant food by grain at different stages of growth and its relation to fertilizers applied in spring.

Field experiments with fertilizers in 1895, EDLER (*Jour. Landw., 46* (*1898*), *No. 4, pp. 349–365*).—This article is a review of the results obtained from work begun by the late Dr. Liebscher, of Göttingen. Cooperative fertilizer experiments were conducted with a view to determining the fertilizer requirements of cultivated soils and the results obtained by the different experimenters are here reported. The author states that owing to lack of uniformity in the conditions no conclusions can be drawn.

Experiments with nitrogenous fertilizers on hoed crops, G. DUSSERRE (*Chron. Agr. Canton Vaud, 11* (*1898*), *No. 23, pp. 668–672*).—The results of experiments with nitrogenous fertilizers on fodder beets are reported. The yields were profitably increased, the amount of dry matter in the beets remained the same, the proportion of protein was considerably increased, and the sugar content slightly diminished.

Box experiments, J. D. KOBUR (*Meded. Proefstat. Oost Java, 3. ser., 1898, No. 7, p. 11*).—An account of experiments with different fertilizers on sugar cane, including detailed analyses (fertilizing constituents) of the canes and blades and sugar content of the canes.

Residual effects of fertilizing oats and clover, sown together, with Thomas slag and superphosphate (*Deut. Landw. Presse, 25* (*1898*), *No. 91, p. 957*).—The land on which the tests were made received a general application of nitrate of soda. The application of Thomas slag and superphosphate furnished 36.84 lbs. of citrate-soluble and 26.59 lbs. of water-soluble phosphoric acid per morgen (0.63 acre), respectively. The Thomas slag plats gave somewhat better yields of oats than the superphosphate plats, and the following year the Thomas slag plats also produced the largest yields of clover. The differences in the yields of clover were much more marked than the differences in the yields of oats.

Curing cigar tobacco, R. S. NEVILL (*Queensland Agr. Jour., 3* (*1898*), *No. 5, pp. 342, 343*).—Instructions for curing cigar tobacco and directions for packing the cured product for the market.

HORTICULTURE.

A comparison of the "Station" tomato with three standard varieties, E. S. Goff (*Wisconsin Sta. Rpt. 1897, pp. 303-306*).—This tomato was produced by crossing the French Upright or Tree Tomato with the Alpha, and has been developed by the author since 1883. Tables are given showing the comparative yield, earliness, and percentage weight of seeds of the Station, Dwarf Champion, Acme, and Nichol Stone varieties. The advantages claimed for the Station tomato are the superior earliness, productiveness, and freedom from decay of the fruit; and the compactness, stockiness, and hardiness of the plants.

On the structure of the epidermal layer and the cause of the varying keeping qualities of pomaceous fruits, A. Zschokke (*Landw. Jahrb. Schweiz, 11 (1897), pp. 153-196, pls. 2*).—The author states that the keeping qualities of fruit are determined by both mechanical and chemical conditions. Chief among the former are the number of stomata, lenticels, and abrasions in the epidermis by which fungi gain access to the flesh of the fruit. The principal chemical conditions are the presence of acids and tannin which generally hinder or prevent fungus growth. Keeping quality in the more restricted use of the term is, however, dependent mostly on physiological conditions and processes within the fruit. The causes of rotting, dotting, and water core of apples and soft overripeness of the pear are discussed.

The application of artificial root pressure to recently transplanted trees, E. S. Goff (*Wisconsin Sta. Rpt. 1897, pp. 272-282, figs. 4*).—The author reports experiments in the application of water pressure to the roots of trees as a means of promoting the starting of their buds and thereby preventing failure in transplanting. A small quantity of distilled water was supported at a height equal to or slightly exceeding that of the tree, and connected by a tube with the cut end of one of the roots of the tree. The effect of the water pressure was often very quickly noticed, sometimes within 48 hours. Pressure was applied in the latter part of May, 1896, to a small, purple beech tree which had been planted in April but had shown no indication of opening its buds. Six days later the buds had opened sufficiently to show the leaves plainly. In the Middle of May water pressure was applied to a tree of the City plum which had been planted nearly a month previous. Several leaf buds had opened but had been dried up by hot, dry weather. A week after the pressure was applied many buds which had not opened before began to swell, and in about another week the leaves were pushing out vigorously.

In the spring of 1897, 20 Whitney crab apple trees were planted in rather poor, dry soil. During the 4 days preceding planting, the roots were exposed to the air but protected from the rain and snow. The trees were planted in the latter part of April without special care, and water pressure was applied to a root of each alternate tree. In one week after planting the buds on the trees supplied with water pressure began to open, and in 2 weeks every tree thus treated was starting well. During

the next 2 weeks with dry, clear weather, the treated trees continued, with one exception, to expand their leaves. By this time the buds on one of the untreated trees began to start, but those on the other untreated trees showed no sign of starting. Later the ground was well irrigated and mulched. All the trees ultimately grew except 2, both failures being in the untreated lot. By fall little difference could be seen between the trees of the treated lot and the live ones of the untreated lot, showing that the advantage of the treatment is only in starting growth. The results of these experiments are shown in figures from photographs.

Trees taken up, removed to a building, injected with water, and returned to their places started promptly after the treatment, the results being striking in some cases. In all cases deciduous trees less than 4 years old were used. The amount of water absorbed from the apparatus up to the time of expansion of the leaves was rarely over 10 cc. The apparatus used in the tests consisted of an inverted flask of water supported on a post by the side of the tree and connected by rubber tubing with a root of the tree. Air was admitted to the flask through a short glass tube. A simpler form of apparatus is recommended for ordinary use consisting of an open cup of galvanized iron soldered to the upper end of a piece of small gas pipe, the lower closed end of which is placed in the ground near the tree. Near the end of the pipe a T is inserted as an outlet for the water and a rubber tube connects the T with the root of the tree.

A test was made to ascertain to what extent slight pressure promotes absorption of water by living wood. A small apple scion was immersed in distilled water and another similar one was connected with distilled water under pressure of between 5½ and 5¾ ft. and left exposed to the air. In about 18 hours water was forced through and dropped from the scion connected with the water pressure. In 118 hours the immersed scion had increased about 17 per cent in weight and the other nearly 26 per cent.

In regard to the practical value of this treatment of trees the author says:

"Trees of which the bark is shriveled and the buds blackened by undue drying, or of which the roots have been killed by severe freezing in dry soil, can not be saved by this treatment. But trees of which the bark and buds are plump, that are unable to expand their leaves, even when the soil about their roots is moist, may generally be assisted to do so by the apparatus here described. The treatment will probably have especial value for trees that it is desired to plant without severe cutting back of the top."

Orchard cultivation, T. J. BURRILL, and J. C. BLAIR (*Illinois Sta. Bul. 52, pp. 105–127, figs. 13*).—In this bulletin the common cause of failure of orchards in Illinois is attributed to the summer drought and the lack of proper cultivation and care to counteract the ill effects of the dry period. Experiments in orchard cultivation and management begun at the station in 1887 are reported and results are presented in

tables and by means of illustrations. In 1890, 3 rows each of Ben Davis and Grimes Golden apple trees were planted. The plantation was divided into 5 plats, 1 of which was cultivated clean, 1 was cropped with oats, 1 with corn, 1 with clover, and 1 was seeded with blue grass. The treatment of the plats has since been continued as at the outset. Typical trees from each of the plats are illustrated. "The marked inferiority of the trees from the oats and grass plats, particularly the latter, may be seen at a glance; while the superiority of the one from the clean cultivation plat, as regards vigorous and healthy appearance and wealth of foliage, is almost equally apparent." The trees in the plat receiving clean cultivation and the corn plat proved superior to those in the grass plat in character of foliage and size of trunk. Measurements show the trees on the corn plat to be slightly larger than those on the clean cultivated plat, but the authors think it would be an error to conclude that cropping an orchard with corn is beneficial. The root-system of the trees in the clean cultivated plat was compact and deep in the soil, while in the other plats the roots ranged nearer the surface and extended farther. Of the 5 methods tried, the results on the whole indicate that clean cultivation is the best, and that cropping with corn, clover, oats, and grass are less desirable in the order named, and that "under no circumstances should hay or any grain crop be grown on orchard land." The percentage of moisture in the first 27 in. of the soil of the 5 plats was shown by analyses made during October 1897 to be as follows: Clean cultivated 12 per cent, corn 12 per cent, clover 10 per cent, oats 8 per cent, grass 8 per cent. During 1897 the main orchard at the station was cultivated 13 times after the spring plowing, at a cost of $16 per acre, or 32 cts. per tree. The tools employed were the ordinary plow, roller, and disk, and spring-tooth and smoothing harrows. Remarks are made on the methods of cultivation and on the preparation of the soil for planting orchard trees.

The green gage group of plums, F. A. WAUGH (*Gard. Chron., 24* (*1898*), *No. 627, pp. 465, 466*).—A history of the group with a discussion of its botanical relationships and position. This study grew out of the author's attempt to trace the 14 varieties of *Prunus domestica* distinguished by Linnæus (E. S. R., 10, p. 640). The green gage group is believed to be the one that gives the best key to the horticultural evolution of the whole species. A chronological conspectus of the more important references to these plums from 1671 to the present time, and a bibliography of the group in America are presented. Their progressive distribution in Italy, France, and England is traced. It is believed that the group was first introduced into America from England where it was known as Green Gage, and later importations of the same tribe were made from France under the name Reine Claude. At the present time the author finds 2 principal varieties of this type in the market: (1) Green Gage, with dwarfish tree, fruit small and early; and (2) Reine Claude de Bavay, which is a stronger growing tree, with fruit later,

larger, and better. Besides these there are numerous varieties of the same groups named and recognized but having only local importance.

The composition of fresh fruits, A. GIRARD (*Bul. [Min. Agr. France], 17 (1898), No. 7, pp. 1523–1528*).—Detailed analyses are reported of fresh strawberries, raspberries, currants (white and red), cherries, figs, apricots, peaches, plums, grapes, pears, apples, and oranges. In nearly every case several varieties were analyzed. The article has a prefatory note by L. Lindet. Several of the analyses follow:

Table showing analyses of red and white currants and the mandarin orange.

	Average weight of fruit.	Skin.	Seed.	Composition of pulp.								
				Water	Protein.	Saccharose.	Reducing sugar.	Acid.*a*	Pectin.	Crude fiber.	Ash.
	Gms.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Pr.ct.*
Red currants	0.60	4.06	10.40	75.09	0.20	0.18	5.96	2.50	0.32	1.28	0.49
White currants	.45	3.65	6.64	78.85	.28	1.04	6.06	2.30	.34	1.15	.51
Mandarin orange	100.00	23.80	2.50	64.01	.33	5.60	.65	.29	.48	1.60	.39

a Calculated as tartaric acid.

The protection of orange groves against frost (*Florida Agr., 25 (1898), No. 10, p. 147; Florida Farmer and Fruit Grower, n. s., 10 (1898), No. 10, p. 147; Pacific Rural Press, 55 (1898), No. 11, p. 170*).—This is the report of a committee appointed by the Riverside (California) Horticultural Club to investigate the various methods suggested for the protection of orange groves against frost. The committee, assisted by some 15 or 20 persons interested, made tests of the numerous methods of frost protection and compared protected orchards with neighboring unprotected ones.

It was found that the temperature in the orchards could be materially raised by the use of dry heat. Burning coal in wire baskets proved the most effective method of warming orchards. Oil pots made a hotter fire, and were neither expensive nor difficult to manage, but the deposit of lampblack upon the fruit made the method unfit for general use. With coal, 20 to 50 fires per acre gave good results. In several cases 20 fires per acre raised the temperature 3 to 5°. The expense of keeping up coal fires for a few nights during the coldest weather is so small in comparison with the value of an orange crop that the method is considered feasible. The 50 wire baskets cost about $5, and the fuel to run them from $2.50 to $3 a night.

The possibility of raising the dew point, by means of steam-producing apparatus, sufficiently to prevent injury on dry, cold nights was thought impracticable. It was found that flooding was of considerable value when used in connection with dry heat or smudges. Covering trees with cloth or matting is considered very effective, but the expense is too great.

The use of moist smudges, made by burning damp straw, very considerably lessened the loss of heat by radiation, especially when they were started early. The results obtained by this means are less

definite, however, than those obtained by the use of dry heat. It is considered a valuable means of protection in localities where the temperature falls but little below the danger point, and where there is a considerable area of orchards together.

The temperature in groves protected by wind-breaks was found to be almost invariably from 1 to 2° higher than in exposed orchards in the immediate neighborhood.

The degree of cold endurable by flower buds of the plum and cherry, E. S. GOFF (*Wisconsin Sta. Rpt. 1897, pp. 309–313, dgm. 1*).—Observations at the Wisconsin Station, with notes from the New York State Station, indicate that flower buds of varieties of the native plum endure without harm a greater degree of cold than those of varieties of the European plum (*Prunus domestica*) or Japan plum (*Prunus triflora*). In Wisconsin during the winter of 1895–96 the temperature at the station was not lower than −13° F., and the flower buds of 8 varieties of *Prunus domestica* were uninjured. During the winter of 1896–97 the temperature was lower than −13° F. on 3 days, and was −23° on one night, and all the flower buds on the same varieties were destroyed, excepting a few on "Orel 20." The flower buds of the cherries Dye House, Large Morello, and Late Morello suffered less from the cold than the buds of the European varieties.

Is the ripening season of a pistillate strawberry affected by the blooming period of its pollenizer? E. S. GOFF (*Wisconsin Sta. Rpt. 1897, pp. 283–285*).—The influence of the pollen of Michel Early, Wilson, and Parker Earle upon the ripening season and fruitfulness of the Warfield strawberry was tested. The experiment was conducted during 2 seasons. The different plats covering about one-half acre were grown under conditions as nearly uniform as possible. The yield of fruit from each plat at each of 12 pickings in both seasons is given in tabular form and the results are summarized by the author as follows:

"When the Warfield was pollenized by Michel Early, an early bloomer, 68.8 per cent of the total crop was gathered in the first 6 pickings. When the Warfield was pollenized by Wilson, an early bloomer, 65 per cent of the total crop was gathered in the first 6 pickings. When the Warfield was pollenized by Parker Earle, a late bloomer, 56.3 per cent of the total crop was gathered in the first 6 pickings."

The average yield for the 2 seasons from the rows pollenized by the early blooming strawberries was somewhat larger than that from the rows pollenized by the late blooming strawberry, but the author suggests that this difference might easily result from an imperceptible variation in the soil.

Cold vs. warm water for greenhouse plants, F. CRANEFIELD (*Wisconsin Sta. Rpt. 1897, pp. 317–320, figs. 2*).—An experiment was conducted to determine the temperature of water best suited to the growth of certain plants under glass. Cuttings of equal length were taken from the top shoots of a single plant of the Golden Bedder coleus and placed in 4 equal compartments of an ordinary greenhouse flat.

The same was done with the Verschaffeltii coleus. The temperature of the water applied to the compartments, numbered 1, 2, 3, and 4, was respectively 35, 50, 65, and 86° F. There was no noticeable difference in root development at the end of 12 days, when the cuttings in each compartment were potted and each lot was watered with water of the same temperature as before. A table shows the growth at 60, 70, and 90 days after the cuttings were taken. At 90 days the plants in lot 1 were about 18 per cent smaller than those in the other 3 lots, which were practically equal, indicating that "the coleus may be watered with water of a temperature from 50 to 80° F., and that there is little choice between these temperatures." Temperature readings taken before watering and at intervals of 1 hour after showed that the temperature of the soil in lot 1 was perceptibly lowered by the watering, and at the end of 3 hours it had not regained its original temperature. In lots 2, 3, and 4 the temperature of the soil was little changed by the watering.

A similar experiment was made with 48 Lorillard tomato plants of uniform size at the beginning of the experiment. These proved to be more susceptible to water of different temperatures than the coleus. Two months after transplanting the plants given water at 35, 50, 65, and 86° F. measured in height 318, 363, 368, and 358 mm., respectively, the best results being obtained apparently with water at 65° F. The experiments are to be repeated on plants growing under outdoor conditions.

Notes on watering, F. CRANEFIELD (*Amer. Florist, 14 (1898), No. 539, p. 256*).—Much of the data in this article is given in the preceding article. After 2 years' work the author believes the following statements can be made: "(1) Water at 35° F. does not injure coleus, begonias, nor geraniums; (2) similar plants treated with water at 50° F. grow equally as well as those watered with water at 65 and 86° F." Warm water appeared to produce an elongated or "drawn" growth, while cold water made the plants short jointed and stocky but well colored and healthy. Though the plants given warm water grew taller they weighed slightly less than those given water at a temperature of 50° F.

Bush fruits, F. W. CARD (*The Macmillan Co., New York, 1898, pp. XII+537, figs. 113*).—This book is one of the Rural Science Series and the first of a proposed series of monographs on the various types of American fruits. The purpose of the work is to present all important phases, both practical and technical, of bush fruit culture and domestication. Bush fruit management in general, comprising location, culture, and marketing, are discussed. Bush fruits are classified as brambles, groselles, and miscellaneous types. The brambles comprise the red raspberry, black raspberry, blackberry, dewberry, oriental raspberry, mayberry, strawberry-raspberry, wineberry, and Chinese raspberry. Certain ornamental species of brambles are also included. The groselles comprise currants and gooseberries. Miscellaneous types occasionally met with, though of no commercial importance in cultivation, are the Buffalo berry, goumi, huckleberry, juneberry, tree cranberry, barberry, and sand cherry. The management of each type of commercial importance is comprehensively

discussed, and an attempt is made to estimate the average yield and profits per acre under favorable conditions of culture.

Notes are given upon the history and future of each type of importance, including as complete a list as possible of varieties, with recommended sorts. The insects and diseases affecting brambles and groselles respectively are enumerated, and those of economic importance are briefly discussed. A systematic study of Ribes and Rubus is made, in which all species, native or cultivated, in America, north of Mexico, are classified and described. The editor has added an appendix of American books treating in part of bush fruits. The usefulness of the book to both grower and student is much enhanced by the treatment of practical and technical subjects in separate chapters.

Measures for the promotion of horticulture and forestry in Sweden, Denmark, Germany, and Austria, J. SMITH (*Tidsskr. Norske Landbr., 5 (1898), No. 5, pp. 215–235*).

The principles of fruit-tree culture, E. LUCAS and F. MEDICUS (*Stuttgart: I. B. Metzler, 1898, pp. 482 + XVI, ill.*).—A text-book.

Observations of the relative moisture content of fruit trees in winter and in summer, C. S. CRANDALL (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 405–407*).—A report is given upon a series of investigations which the author conducted with samples of trunks and branches of apple trees taken January 15 and 16 and August 3. The specimens were thoroughly air dried, carefully weighed before and after the drying, and the percentage of loss in each case is given in a table. From the trial made it seems reasonable to conclude that there was hardly any appreciable difference between the winter and summer moisture contained in apple trees, at least when grown under Colorado conditions.

Some conditions which influence the setting of fruit, S. A. BEACH (*East. New York Hort., 2 (1898), No. 2, pp. 6, 7*).—This is a paper read before the Eastern New York Horticultural Society. The author enumerates the following factors which influence in a most marked degree the development of fruit buds and thereby the production of fruit, and which are largely under the control of the fruit grower: "The kind and quantity of fertilizers which are applied to the soil, the supply of moisture in the soil, the condition of the foliage, and the directing of the supply of plant food to different parts of the plant by judicious pruning. Those things which are beyond the fruit grower's control, and which combine to vary the results, are temperature, light, and atmospheric moisture."

Manurial requirements of orchard and fruit trees, J. J. WILLIS (*Gard. Chron., 3. ser., 25 (1899), No. 630, p. 36*).—A discussion of principles.

History of the Gano apple, H. E. VAN DEMAN (*Amer. Gard., 20 (1899), No. 215, p. 81*).

A preliminary study of the prickly pears naturalized in New South Wales, J. H. MAIDEN (*Dept. Agr. New South Wales, Misc. Pub. 253, pp. 30, pls. 6*).—Extracts from the law providing for the eradication of the prickly pear, with notes upon its administration. Notes on the prickly pear in other countries and a brief bibliography of the prickly pear as a fodder plant are given. The species naturalized in New South Wales are described and the synonymy discussed.

A new fruit (*Tidsskr. Norske Landbr., 5 (1898), No. 11, p. 566*).—A French botanist, Andrée, has found a new fruit tree in his travels in the Argentine Republic (La Plata). The tree, Feijoa Sellowana, is 3 to 5 meters high. The fruit is an elongated egg-shaped berry, 4 to 6 cm. long and 3 to 5 cm. broad; it retains its green color when ripe. The meat of the fruit is firm, white, very juicy, and sweet, and tastes much like pineapple. The tree is now planted in the south of France, where it thrives excellently. If it will grow in other parts of Europe, Andrée is of the opinion that it will prove a valuable southern fruit for Europe.

Small fruits, E. S. GOFF (*Wisconsin Sta. Rpt. 1897, pp. 313–316*).—Notes and variety tests on European cherries, strawberries, gooseberries, golden mayberry, strawberry-raspberry, and currants.

Cranberry growing in Nova Scotia, J. CRAIG (*Amer. Gard., 20 (1899), No. 214, p. 63, figs. 2*).

The strawberry-raspberry, W. E. BRITTON (*Amer. Gard., 20 (1899), No. 215, p. 63, figs. 2*).—Descriptive and cultural notes.

Nutrition and protection of the vine by injection, L. MANGIN (*Jour. Agr. Prat., 1898, II, No. 52, pp. 918–920*).—Statement and unfavorable criticism of Berget's theory that the vine may in practice be protected from the attacks of fungi by injection of copper salts into the stem and advantageously nourished by injection of a solution of phosphate of ammonia.

The productiveness of grafts on Vitis rupestris and V. riparia, J. M. GUILLON (*Jour. Agr. Prat., 1898, II, No. 51, pp. 899, 900*).—Abstract of a bulletin of the viticultural station of Cognac. The comparative productiveness of grafts on these stocks is studied. The must of rupestris was found to contain 148 gr. sugar per liter, riparia 191 gr.

Packing and shipping fruits, C. C. BELL (*Gardening, 7 (1899), No. 153, pp. 138–140*).—A paper read at the last annual meeting of the Illinois Horticultural Society.

Preservation of fruits in lime (*Belg. Hort. et Agr., 10 (1898), No. 24, p. 378*).—In experiments in France grapes packed in lime for 7½ months were found still very fresh. Winter pears and quinces which otherwise could be kept only 2 or 3 months were preserved until fully ripe. It is stated that lime does not retard decay when produced by physiological causes. It protects the fruit only from external causes of decay, such as dampness, vermin, insects, and microbes. With the use of lime it is not necessary to make any special provision for storage.

Preserving in tins, or the art of canning, A. M. HOWELL (*Agr. Gaz. New South Wales, 9 (1898), No. 10, pp. 1181–1190, figs. 6*).—Methods of canning on a small scale. Among the subjects treated are canning in tins with solder, the home cannery, the wax-sealing method, standard methods, exhausting the cans of air, testing cans for leaks, the sterilizing process, and general formulas for canning.

Pulping fruit (*California Fruit Grower, 24 (1899), No. 4, p. 4*).—Notes upon the process in Australia and the utilization of the product.

The use and construction of greenhouses for horticulturists, L. R. TAFT (*Florists' Exchange, 11 (1899), No. 4, pp. 73, 74; Gardening, 7 (1899), No. 154, pp. 153–155*).—Abstract from a paper read before the Missouri State Horticultural Society.

The water garden, W. TRICKER (*New York: A. T. De La Mare Printing and Publishing Co., Ltd., 1897, pp. 120, pls. 27, figs. 20, dgms. 5*).—The work discusses the construction of ponds, adapting natural streams, planting, hybridizing, seed saving, propagation, building an aquatic house, wintering, correct designing and planting of banks and margins, together with cultural directions for all ornamental aquatics. Descriptive notes with cultural memoranda are given for water lilies, miscellaneous aquatic plants, orchids, ferns, and hardy perennials, hardy shrubs, and trees suitable for wet or moist situations. The illustrations represent various cultivated aquatics and treatment of water scenes in landscape gardening. Artificial ponds and an aquatic house are figured. The plates are numerous and artistically executed.

Further notes on watering, F. CRANEFIELD (*Gardening, 7 (1899), No. 154, pp. 152, 153*).—A continuation of experiments reported on page 756, with similar conclusions.

Cultural directions for begonias, C. W. RANKIN, A. E. LEY, and P. B. KENNEDY (*Amer. Gard., 20 (1899), No. 213, pp. 45, 46, pls. 4*).—Papers submitted in competition for a prize.

Propagating ferns (*Garden, 55 (1899), No. 1418, p. 33*).

Phacelias (*Garden, 55 (1899), No. 1418, pp. 36, 37, pl. 1*).—Botanical and cultural notes.

Grafted roses, R. CRAIG (*Amer. Gard., 20 (1899), No. 214, pp. 61, 62*).

The principles of rose pruning (*Success with Flowers, 9 (1899), No. 5, pp. 97–99, figs. 5*).

SEEDS—WEEDS.

The influence of varying amounts of water on the germination of beet seed, E. S. GOFF (*Wisconsin Sta. Rpt. 1897, pp. 299–302, figs. 2*).—The author states that in testing seed in a Geneva tester he frequently noted the influence of varying amounts of water in the cloth. This is more apparent with beet seed than with other species which have been tested. If the corky covering becomes saturated with water, the oxygen may be so far shut out as to prevent germination. In order to test the influence of varying amounts of water on germination a series of experiments was conducted with 22 lots of beet seed from various sources. In one apparatus the ends of the cloth of the Geneva tester were constantly immersed in the water of the pan, the level of which was slightly below the bottom of the pockets. In the other the cloth was wrung out as nearly dry as possible without removing the wires and placed in the empty pan and no further water was added. In this apparatus provision was made against undue evaporation. One hundred seed balls of the sugar-beet seed were placed in each pocket and the 2 testers were placed in the horticultural laboratory, in which the temperature varied during the test from 70 to 90° F. The average germination from the 2 testers showed a difference of 50 plantlets for each 100 seed balls in favor of the drier cloth. It would appear from these results that the germination of beet seed in the open ground is liable to be prevented by excessive water in the soil.

Resistance of seed to immersion in water, H. COUPIN (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 19, pp. 1365–1368*).—On account of the importance of water as a factor in seed dissemination, the author has made a study of the effect on the vitality of seed of their prolonged immersion in water. Some of the injurious effects are pointed out, notably the osmotic pressure of liquids in the cells, the loss of soluble material in seed, the presence of bacteria which dissolve cellulose and produce butyric fermentation, the lack of oxygen, and finally the attack of various low organisms. In one set of trials the water was changed every 24 hours, while in the other it remained unchanged from the beginning of the experiment. The following table shows the length of time seeds were immersed in water before their vitality was destroyed.

Number of days within which seed vitality was destroyed by soaking.

Kind of seed.	Water changed.	Water not changed.	Kind of seed.	Water changed.	Water not changed.
	Days.	Days.		Days.	Days.
Beets	148	30	White mustard	7	5
Mullein	115	49	Mallow	6	10
Leeks	90	45	Sunflower	110	....
Asparagus	75	145	Stock	20	....
Borage	57	28	Castor bean	....	68
Anise	57	21	Harry vetch	....	45
Sweet fennel	39	30	Crimson clover	....	32
Poppy	27	25	Cytisus	....	30
Flax	13	12	Hemp	....	12
Wheat	10	17	Maize	....	10
Oats	9	11	Buckwheat	....	3
Millet	9	6			

A second series of experiments was conducted to test the effect on germination of immersion in running and still water. Comparable lots of different seeds were immersed in running and still water for 24 and 48 hours with the following results:

Effect of soaking on percentage of germination of seed.

Kind of seed.	In running water.		In still water.	
	24 hours.	48 hours.	24 hours.	48 hours.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Buckwheat	81	70	55	52
Wheat	99.6	100	64	97
Maize	85	89	84	80
Peas	98	97	94	85

In addition to the facts shown in this table, it is found that still water not only destroys the germinative ability of some seeds, but also retards it in others. In the case of buckwheat placed in running water, most of the seeds germinated within 24 hours after being placed in the germinating chamber, while those soaked in still water did not germinate until after the second day.

The flaxseed in its botanical, chemical, and agricultural relations (*Der Leinsame in botanischer, chemischer und landwirtschaftlicher Beziehung; noted in Deut. Landw. Presse, 25 (1898), No. 59, p. 660*).

On the ripening of seed, W. JOHANSEN (*Abs. in Norsk Landmandsblad, 17 (1898), No. 35, pp. 373–375; 36, pp. 384–386; 37, pp. 399–402*).

Combating juncus in meadows and pastures (*Deut. Landw. Presse, 25 (1898), No. 81, p. 869*).—Recommends addition of lime, kainit, and other fertilizers.

Combating mustards with iron sulphate (*Deut. Landw. Presse, 25 (1898), No. 48, p. 523; 60, p. 667*).

The Russian thistle in Washington, C. V. PIPER (*Washington Sta. Bul. 34, pp. 18, pls. 2*).—The author notes the occurrence of the Russian thistle (*Salsola kali tragus*) in a number of places throughout the State, and a description of the plant is given with suggestions for its destruction. Numerous weeds which are sometimes mistaken for the Russian thistle are briefly described, and an appeal made to farmers to prevent the spread of this pest.

Twelve of Idaho's worst weeds, L. F. HENDERSON (*Idaho Sta. Bul. 14, pp. 91–136, pls. 13, figs. 5*).—Descriptive notes are given of 12 of the worst weeds of Idaho, together with the methods by which they are distributed and suggestions for their eradication. The following is a list of the weeds: Wild oats, prickly lettuce or compass weed, Russian thistle, tumbling mustard, cow herb, Canada thistle, dodder, false flax, sunflower, squirrel-tail grass, common tumbleweed, and horehound.

Report of the botanist and entomologist, C. V. PIPER (*Washington Sta. Rpt. 1896, pp. 29–39*).—The author briefly reviews the laboratory work of the year, gives notes on the occurrence of the Russian thistle, and states that a bulletin is in course of preparation in which attention will be called to the most serious weed pests of the State. Need of a revision of the State weed law is pointed out, and notes are given on the herbarium and field botanical work of the season. The entomological work of the season is briefly described, and reference made to the more common injurious insects (E. S. R., 8, p. 321).

DISEASES OF PLANTS.

Potato diseases, E. ROZE (*Gard. Chron., 3. ser., 24 (1898), No. 608, p. 134.*)—The conclusions of the author as to the cause of various potato diseases are given. He states that the dry rot is produced by *Pseudocommis vitis*, in which case the tubers are free from any odor, but show depressed dark spots in the parenchyma with a brownish band surrounding. These tubers can be kept until spring, when they develop shoots which bear brownish or blackish tips. Dry rot may also be produced by a species of Micrococcus. In the case of this form of attack the tubers are said to be free from odor, moderately firm, more or less soft in spots, but showing in certain places a loose epidermis which yields to the pressure of the finger. Under this epidermis the parenchyma exhibits white, gray, or brownish blotches. Sometimes there are depressions which exhibit the sclerotia of Rhizoctonium or later an abundant development of Fusisporium and Spicaria.

The wet rot is produced by a species of Micrococcus closely allied to *Bacillus subtilis.* The tubers are partly or wholly soft and exhale a very disagreeable odor. Under the epidermis there is a disintegration of parenchyma with an elaboration of butyric acid. Destruction is slow and progressive and contact with healthy varieties should be avoided. Wet rot is also said to be produced by *Phytophthora infestans*, in which case there is a partial or complete softening of the tissue, the epidermis is shrunken, the parenchyma which is weakened is depressed, pasty, but not deliquescent. The author states that of the different forms of potato rot at least 50 per cent of the tubers are attacked by *Micrococcus* sp. and 25 per cent by the Pseudocommis, while a still smaller amount is due to Phytophthora.

The remedies recommended are alternation of crops, planting of healthy tubers, destruction at harvest of all diseased potatoes, and treatment of the plants with copper fungicides.

Diseased potatoes, G. ABBEY (*Jour. Hort., 50 (1898), No. 2620, pp. 463, 464, fig. 1*).—Specimens of some badly infested tubers were submitted to the author for examination, and he reports finding in one of them several wireworms and quite a number of small forms closely related to the springtails. In another specimen several protuberances of various kinds were noted, some just beginning, while others were in a more advanced stage of development. No trace of animal life was discovered in the cracks of the excrescences, which were black and moist, the warts being brown and scabbed. A closer examination of these tubers showed the presence of the scab fungus *Oöspora scabies*, but the main trouble, the author states, could not be attributed to this cause. A slimy fungus closely related to the Plasmodiophora was present in abundance. It is stated that it may be *Pseudocommis vitis*, although the resemblance is not sufficiently clear. Besides the various parasites already mentioned there were found present *Bacillus amylobacter*, the mycelium of *Fusarium solani*, a root worm (*Enchytræus*

minutus), an eel worm (*Tylenchus obtusus*), and the mite *Rhizoglyphus echinopus*.

For the prevention of all these attacks on the potato the author recommends treating the tubers before planting with a solution of corrosive sublimate and planting in soil that has been heavily limed. The application of kainit is also recommended, applications of 10 tons of lime and 10 cwt. of kainit being applied in the fall, the lime to be first plowed under and then the kainit applied as a top-dressing.

The effect of various copper preparations on the potato, R. THIELE (*Ztschr. Pflanzenkrank.*, *8* (*1898*), *No. 2*, *pp. 70–80*).—The author reports the effect of applications of fostite, a copper sucrate solution, a copper, sulphur and lime powder, and copper calcite. Fifty varieties of potatoes were planted in rows, but so arranged in different plats that treated and checked lots were comparable. Some of the results of the applications are tabulated, showing that the different fungicides affected different varieties differently. The potato blight was greatly restricted by the use of all the fungicides except the copper, sulphur and lime powder. The plat where this was applied showed the greatest amount of disease of any of the treated plats and exceeded some of the control plats in this respect.

The influence of the treatment on the yield of different varieties is shown. The gains and losses were about equal. It was apparent, however, that there were a greater number of small tubers on the plants in the sprayed plats than in the others, and the author believes that this was due to the fact that the copper preparations prolonged the growing period of the plants and at the same time checked to some extent the growth of the tubers. He states, however, that if the period of growth could be prolonged sufficiently to mature the small tubers that in all probability the yield would be considerably increased by the application of the fungicide.

A new copper fungicide for combating black rot, J. PERRAUD (*Jour. Agr. Prat.*, *62* (*1898*), *No. 50*, *pp. 819*, *850*).—The author describes a form of fungicide which he claims is very efficient in preventing attacks of black rot. The method of preparation is fully given as well as the formula, which consists of water 100 liters, copper sulphate 2 kg., and resin 0.5 kg. Carbonate of soda sufficient to render the solution slightly alkaline is added. Another formula given contains only half of the above amount of copper. This fungicide has been tested and compared with ordinary Bordeaux mixture to which soap was added, and the total amount of copper adhering to the grapes was somewhat higher than in the case of the other fungicide. The tenacity with which it is held upon the fruit and foliage is said to be the most important factor in its favor.

A trial of "Ceres pulver" for the prevention of smut in oats, E. S. GOFF (*Wisconsin Sta. Rpt. 1897*, *pp. 307–309*).—A comparison was made of Ceres pulver and hot-water treatment as a means of preventing smut in oats. The grain used for seed was from a crop that had

been nearly destroyed by smut the preceding year. Untreated seed produced 10.2 per cent of smutted heads, seed treated with Ceres pulver, 2.7 per cent, and seed treated with hot water, 0.00075 per cent. The author is inclined to believe the amount of water recommended for dissolving the Ceres pulver (3.2 oz. in 10 qt.) is insufficient to saturate the hulls of the oats, and that the use of a little more water might have made the treatment more effective.

Diseases of plants, A. P. ANDERSON (*South Carolina Sta. Bul. 36, pp. 17, figs. 14*).—A brief popular description is given of the different classes of plant diseases due to fungi, bacteria, or other causes.

Disease in vegetable life, W. T. SEDGWICK (*Florists' Exchange, 11 (1899), No. 3, p. 56*).—Abstract of a lecture discussing the lines along which prevention of disease and promotion of health must work. These are stated to be improvement of the mechanism and control and amelioration of the environment, the latter eventually attended by improvement of the organism itself considered as a physical mechanism.

Report of the department of botany, L. H. HENDERSON (*Idaho Sta. Bul. 15, pp. 151-162*).—The author briefly reviews the work of the year and gives notes on the occurrence of and approved remedies for a number of orchard and garden diseases which have appeared in Idaho.

The leaf-spot disease of apple (Phyllosticta pirina), and several unrelated forms occurring therewith, W. B. ALWOOD (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 413*).—The author gives notes on the common occurrence and life cycle of this fungus and mentions the occurrence therewith of 3 apparently unrelated forms, viz., *Sphæropsis malorum, Hendersonia mali*, and an undetermined species.

The apple mildew in the Tyrol, P. MAGNUS (*Ber. Deut. Bot. Gesell., 16 (1898), No. 9, pp. 331-334, pl. 1*).—Notes the occurrence of *Sphærotheca mali* on the apple in the Tyrol. It had associated with it *Podosphæra* sp.

Monilia fructigena and the Monilia disease of fruit trees, C. WEHMER (*Ber. Deut. Bot. Gesell., 16 (1898), No. 9, pp. 298-307, pl. 1*).—A sketch is given of the distribution, history, characters of the fungus, nature of its attack, and means for combating the Monilia disease of apple, pear, cherry, etc.

Report on the investigation of the disease of the roots of the mulberry tree on the Caucasus, A. YACHEVSKI (*Selsk. Khoz. i Lyesor., 190 (1898), No. 9, pp. 653-660*).—According to the author, *Demataphora necatrix* is the cause of the disease of the mulberry tree in the Caucasus.

On the appearance of, and methods for combating, grape injuries in Germany in 1896, MORITZ (*Abs. in Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 22 pp. 842, 843*).—The first part of this work discusses the effect of atmospheric conditions, such as late frosts and hailstorms, and suggests how to overcome their injury.

In the second part of the treatise the author mentions the principal troublesome insects of the grape. Those especially described are *Conchylis ambiguella, Rhynchites bebuleti, Otiorhynchus ligustici, Eumolopus vitis*, the cankerworm, *Melolontha vulgaris, Phytoptus vitis*, and *Tetranychus telarius*. Among the diseases described and for which remedies are suggested the following fungi are noted: *Peronospora viticola, Oïdium tuckeri, Sphaceloma ampelinum, Dematophora necatrix, Botrytis cinerea*, and several other diseases of unknown origin.

Investigations on the life history of rust fungi, E. FISCHER (*Entwickelungsgeschichtliche Untersuchungen über Rostpilze. Bern: K. J. Wyss, 1898, pp. X+121, pls. 2, figs. 16*).—This is a preliminary contribution to a monograph of the Swiss Uredineæ and was published by *Sweiz. Naturforsch. Gesellschaft.*

Descriptions of American Uredineæ, II, J. C. ARTHUR and E. W. D. HOLWAY (*Bul. Lab. Nat. Hist. Univ. Iowa, 4 (1898), No. 4, pp. 377-402, pls. 11*).—Descriptions and notes are given of a number of species of Uredineæ that have been distributed by the authors.

Cereal blights and the liming and sulphuring of the seed grain, E. PIRET (*Agronome, 1898, No. 40*).

The gum flow of the sereh disease of sugar cane, A. WIELER (*Beitr. Wiss. Bot., 2 (1898), pp. 29–140*).

The parasitic diseases of sugar beets (*Agr. Rationelle, 1898, No. 20*).

The biology of some parasitic fungi, M. NORDHAUSEN (*Jahrb. Wiss. Bot. [Pringsheim], 33 (1898), No. 1, pp. 1–46*).—This paper treats of the conditions and manner of infection by *Botrytis cinerea*, conditions of the host plant for successful infection, the occurrence of *B. cinerea* and related fungi in nature, and studies of Penicillium and Mucor as representatives of saprophytic life.

On the presence of a fungus in Lolium temulentum, P. GUÉRIN (*Jour. Bot. France, 12 (1898), No. 15–16, pp. 230–238, figs. 5*).—The author reports finding in the grain of this plant a fungus of a somewhat similar nature to the ergot of rye, and thinks the poisonous properties of the plant may be due to this cause.

Notes on the occurrence of a fungus in Lolium temulentum, P. GUÉRIN (*Jour. Bot. France, 12 (1898), No. 23–24, pp. 384, 385*).—Attention is called to the publication by the author in August, 1898, mentioning the presence of a fungus in the grains of the darnel, the name *Endoconidium temulentum* having been given it. This paper seems to have been overlooked by Hanausek and Nestler.[1] The conclusions of the different authors agree in the main, except Guérin finds this fungus on other species than *L. temulentum*, such as on *L. perenne* and *L. linicola*, and its wholly saprophytic nature is questioned.

A comparative study of some anthracnoses, B. M. STONEMAN (*Bot. Gaz., 26 (1898), No. 2, pp. 69–120, pls. 12*).

The stem-rot disease of carnations, W. E. BRITTON (*Gardening, 7 (1899), No. 153, p. 138*).—Notes on unsuccessful attempts to check the disease. Destruction of all diseased plants, propagation only from healthy ones, and the use of fresh soil are believed to be the most nearly successful methods of control yet known. Antirrhinums and asters have been affected in a similar manner. That the same fungus attacks these 3 plants is believed to be probable.

A disease of the loquat, G. QUINN (*Jour. Agr. and Ind., S. Australia, 2 (1898), No. 5, pp. 400, 401, fig. 1*).—The occurrence of a destructive disease of loquats, due to *Fusicladium eriobotryæ*, is mentioned. The application of Bordeaux mixture has been tried and is recommended for its prevention. All diseased fruits and leaves should be collected and burned.

Rose mildew, G. SCALIA (*Bol. Ent. Agr. e Patol. Veg., 5 (1898), pp. 17–21; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, p. 304*).—The author notes an unusual outbreak of this fungus, and states that the atmospheric conditions had been exceptionally favorable for the development and spread of the disease. Sulphur dusted on the plants is recommended as treatment. *Sphærotheca pannosa* is also noted as abundant on peach trees.

The clematis disease, J. JENSEN (*Amer. Florist, 14 (1899), No. 555, p. 740*).—Notes are given of the disease, and quotations from various investigators seem to indicate that the trouble is a physiological one. Sorauer is quoted as saying it is due to too much nourishment, water, and heat. The Florida and lanuginosa types seem most subject to the dying off that characterizes this particular disease.

On the presence of Septoria curvata on Robinia, A. MORI (*Staz. Sper. Agr. Ital., 31 (1898), No. 5, p. 499*).—Notes the attack of this fungus on *Robinia pseudacaciæ*. The circular brown spots, with their numerous perithecia, are said to be quite abundant on the leaves and have proved very destructive to the trees.

The cause of chlorosis in green leaves, C. MOHR (*Gartenwelt, 2 (1898), No. 48, p. 569; abs. in Bot. Centbl., 76 (1898), No. 8, p. 282*).—The author does not consider chlorosis a disease, and for its prevention recommends the use as a fertilizer of a

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[1] Ber. Deut. Bot. Gesell., 16 (1898), No. 8.

strong solution of iron sulphate and lime, in order that the plant should receive sufficient iron.

Eel worms in grape roots, G. ABBEY (*Jour. Hort., 51 (1899), No. 2623, pp. 14, 15, figs. 2*).—Notes the presence of *Heterodera radicicola* on grape roots. The life history of the nematode and means for its destruction are given. The application to the roots of a solution of 3 oz. of Little's soluble phenyl in 3 gal. of water is recommended. Digging about the roots and applying nitrate of soda and sulphate of ammonia is also recommended.

ENTOMOLOGY.

On the poison of honeybees, J. LANGER (*Arch. Exper. Pathol. u. Pharmakol., 38 (1897), pp. 381–396; abs. in Jahresber. Thier. Chem., 27 (1897), pp. 520, 521*).—The poison drop, freshly excreted, weighs from 0.0002 to 0.0004 gm. It has a specific gravity of 1.0013, is clear as water, and has a marked acid reaction, bitter taste, and a pleasant aromatic odor. The poison was obtained by collecting the drops or by extracting the entire poison apparatus with alcohol. This caused coagulation, and the poison was taken up by the alcohol. When the alcohol was supersaturated with ammonia and evaporated a yellowish material was obtained. Solutions of this gave reactions of formic acid. The author's investigations, however, showed that formic acid does not possess the poisonous properties of the bee poison. The solution of the poison contains an albuminoid, hydrochloric and phosphoric acids, sodium, and calcium. The albumin does not produce the poisoning, since a solution of the poison freed from it produced poisoning symptoms, as observed on the conjunctiva of a rabbit's eye. Evaporating the poison and heating at 100° does not diminish its properties, nor does keeping it for some time in sealed capillary tubes. On the other hand, when kept in open glass tubes the poisonous properties are lost in about 4 weeks. The poison spoils on standing and loses its toxic properties. The poisonous substance is held in suspension by acid, and can be precipitated by alkali. This shows that the active principle secreted by members of the aculeata group of Hymenoptera is a base.

Report of the department of entomology, J. M. ALDRICH (*Idaho Sta. Bul. 15, pp. 167–176, fig. 1, pl. 1*).—This bulletin gives a brief account of the work of the year and the result of several investigations.

An investigation of the grasshoppers (*Camnula pellucida*) in a few localities in the State is reported. A method which was found very useful in destroying young grasshoppers was to drive them together by partly flooding the ground by irrigation ditches, and to burn them during the cool part of the day through the aid of straw. Where this treatment was impracticable hopperdozers were employed. The young grasshoppers did not jump into the hopperdozer when it was drawn along, but did so when it was left standing and they were driven toward it.

A few experiments were made to determine whether kerosene could be successfully and economically used to rid certain localities of the mosquito plague and to determine how large a pond could be successfully treated. The test did not result satisfactorily.

"The conclusion from this experiment is that kerosene to be effective against mosquito larvæ must cover the surface to a perceptible depth; a mere film will not answer. As the usual market price of the oil in small quantities throughout Idaho is 30 to 35 cts. a gallon, the cost will be prohibitive except in thickly settled communities and on small bodies of water, where the remedy will doubtless be of marked usefulness."

Some differences between the Putnam scale and the San José scale are pointed out. The characteristics, habits, and injuries of the box-elder bug are considered.

Some insects of the year 1897, W. B. BARROWS and R. H. PETTIT (*Michigan Sta. Bul. 160, pp. 339–436, figs. 29*).—Notes are given of 28 species of insects which were more or less troublesome during the season indicated. These were not necessarily the ones that caused the most damage, but as it is considered impracticable to publish in a single bulletin a treatise which shall cover all insect enemies, it is thought the selection made will prove to be the most serviceable. The insects treated are the following: Grasshoppers (*Melanoplus femur-rubrum* and *M. atlanis*), pear psylla (*Psylla pyricola*), aphids of plum, cherry, and apple (*Aphis prunicola*, *Myzus cerasi*, and *A. mali*), black peach aphis (*A. persicæ-niger*), woolly aphis of apple (*Schizoneura lanigera*), San José scale (*Aspidiotus perniciosus*), eccentric scale (*A. ancylus*), oyster-shell bark louse (*Mytilaspis pomorum*), white scale of the pine (*Chionaspis pinifolii*), scurvy scale of the pear and apple (*C. furfurus*), plum scale (*Lecanium cerasifex*), currant scale (*L. ribesii*), cankerworms (*Anisopteryx pometaria* and *Paleacrita vernata*), apple-leaf tier (*Teras minuta cinderella*), bud moth (*Tmetocera ocellana*), army worm (*Leucania unipuncta*), erratic army worm (*Noctua fennica*), zebra caterpillar (*Mamestra picta*), cat and dog flea (*Pulex serraticeps*), grape-cane borer (*Amphicerus bicaudatus*), cherry-leaf beetle (*Galerucella cavicollis*), asparagus beetle (*Crioceris asparagi*), pear slug (*Eriocampa cerasi*), and white-pine sawfly (*Lophyrus lecontei*).

On the biology and taxonomy of some species of mining Diptera, W. C. BRASHUIKOV (*Nachricht Moskauer Landw. Instituts, 3 (1897), pp. 22, pls. 1, and figs.; abs. in Zool. Centbl., 5 (1898), No. 7, pp. 234–236*).—Observations were made on the 3 genera of Muscidæ—Phytomyza, Agromyza, and Anthomyia. The larvæ of *Phytomyza geniculata* mine the leaves of different Compositæ of *Pisum sativum*, *Cucumeris sativa*, several Cruciferæ, etc., and are also polyphagous—a habit not found in other mining Diptera. The eggs are laid on the under surface of the leaves, the larvæ eat through the epidermis of the leaf, and make irregular passages in its interior. In a single leaf 1 or 2 larvæ may be found. Pupation always takes place on the under leaf surfaces, where the larva sticks its head somewhat out of the leaf. The larva

of *P. attra* always mines along the leaf rib. Larva of *P. flavoscutellata* does not pupate in the leaf but hides in the earth; that of *P. bipunctata* mines the upper surface of the leaf and pupates in the earth. The larva of *Agromyza pulicaria* always ends its mined passages with 1 to 1½ spiral turns. Near the time of pupation the larva assumes a lively green color, closely resembling the leaf. The larva of *A. strigata* pupates in the leaf. In *Anthomyia nigritarsis* several larvæ generally mine in the same passage. Sometimes several groups are met with in a single leaf and the latter in such cases is completely hollowed out. This species especially is to be considered as injurious in contrast to the true miners of the last 2 genera.

The author believes that the genera Phytomyza and Agromyza may have been derived from a form related to Anthomyia. To this form Agromyza stands nearest, followed by the subgenus Ophiomyia.

A new squash bug, F. H. CHITTENDEN (*Canad. Ent., 30 (1898), No. 9, pp. 239, 240*).—While investigating the insects affecting cucurbits the author discovered that in addition to the common squash bug a second species is present in certain parts of this country. This insect (*Anasa armigera*) has been observed in a number of places around Washington, D. C., and it appears to have very much the habits of the more common squash bug, *A. tristis*, preferring the squash to all other cultivated plants, but feeding on the cantaloupe or other cucurbits when the squash is not available. This new insect is said to be much more active than the common form and has a later season, appearing 3 weeks later and remaining in the field after the common species has gone into hibernation. In size *A. armigera* is nearly the same as *A. tristis*, but may be readily distinguished from it by a broader prothorax and more prominent angles, the reflected sides of the abdomen showing 4 prominent white marks on the hemelytra, and its armed femora, from which it derives its specific name. The author believes this is a more southern insect and is not liable to become a serious pest in its northern range, although it is capable of severely injuring late crops of all cucurbits. In addition to the localities already mentioned this species is known to occur in Kansas, western Iowa, and Florida.

Scale insects, C. E. CHAMBLISS (*Tennessee Sta. Bul., Vol. X, No. 4, pp. 141–151, pl. 1, fig. 1*).—Notes are given on the San José and other scale insects which have been observed in Tennessee. At present the San José scale is known to occur in 4 localities in the State. So far as reported its food plants in Tennessee are the apple, peach, plum, pear, apricot, grape, and English walnut. The life history of the scale is given and suggestions made for combating it. From experiments conducted at the station it was learned that two applications of either whale-oil soap or caustic potash soap used at the rate of 2 lbs. per gallon of water is very effective in destroying the scale. Its efficiency is greatly increased on trees having a very rough bark by brushing the trunks and larger limbs.

Descriptions and brief notes on the life history are given of the following additional scale insects: Oyster-shell bark louse (*Mytilaspis pomorum*), scurfy bark louse (*Chionaspis furfurus*), rose scale (*Diaspis rosæ*), cottony maple scale (*Pulvinaria innumerabilis*), grape scale (*Aspidiotus uvæ*), and peach lecanium (*Lecanium nigrofasciata*).

The bulletin concludes with remarks on the natural enemies of scale insects and gives directions for remedial treatment.

The life history of Schizoneura lanigera, W. B. ALWOOD (*Science, n. ser., 8 (1898), No. 195, p. 400*).—In a paper read before Section F of the American Association for the Advancement of Science, the author states that breeding records show that the root and stem forms of this insect can be colonized from root to stem or the reverse. Many of the agamic wingless females at Blacksburg, Virginia, survive the winter exposed on aerial situations. Twelve generations of agamic viviparous females have been observed from May 12 to September 20. At this time winged agamic viviparous females were observed in all colonies examined. Under normal conditions these proved migratory, but in confinement they produced 4 to 6 young, which were sexed individuals. These are small, beakless, and are produced in about the proportion of 2 females to 1 male. After copulation the females lay one egg, which remains dormant during the winter.

From long observations it is concluded that in southern latitudes agamic individuals continue in an unbroken chain and oviparous reproduction plays no important rôle in the life cycle.

The proposed attempt to introduce Blastophaga psenes into California, L. O. HOWARD (*Science, n. ser., 8 (1898), No. 195, pp. 399, 400*).—In a paper read before Section F of the American Association for the Advancement of Science at its meeting in August, 1898, the author gives an account of the attempts made to introduce these insects into California. The practice of fig growers in utilizing this insect which inhabits the wild Capri fig is stated, and the belief is expressed that if the Blastophaga could be established in California a fig could be grown quite as good as those imported. Capri figs with their insects have been repeatedly imported, but attempts to establish the species have not been very successful. The author believes the time has come to carry on these experiments in a larger way and believes it will be successful.

Elements of apiculture, R. HOMMELL (*L'apiculture par les méthodes simples. Paris: G. Carre and C. Naud, 1898, pp. 338, pls. 6, figs. 102*).

Natural history, anatomy, and physiology of the bee, T. W. COWAN (*Rev. Internat. Apicult., 20 (1898), No. 12, pp. 231–236, figs. 3*).

Beneficial insects (*Jour. Bd. Agr. [London], 5 (1898), No. 3, pp. 326–334, figs. 2*).—Brief notes are given of various ladybirds, syrphus flies, lacewings, and ichneumon flies.

Report of the State entomologist of Norway for 1897, W. SCHÖYEN (*Aarsber. Offent. Foranst. Fremme, 1897, pp. 57–99, ill.*).

Reports of injurious insects in Finland during 1897, E. REUTER (*Landbr. Styr. Meddel, 1898, No. 23, pp. 70*).

Handbook of insects injurious to orchard and bush fruits, E. A. ORMEROD (*London: Simpkin, Marshall & Co., 1898, pp. 286, ill.; rev. in Canad. Ent., 30 (1898),*

No. 12, p. 328).—The different crops treated are apple, cherry, currant, gooseberry, medlar, pear, plum, quince, raspberry, and strawberry. The insects are given with their scientific and popular names, and so far as possible are grouped together. The latest remedies are suggested for the repression of these pests.

A new method of studying underground insects, J. B. SMITH (*Science, n. ser., 8 (1898), No. 195, pp. 398, 399*).—This is an abstract of a paper read before Section F of the American Association for the Advancement of Science at its Boston meeting, in which the author states that plaster Paris thinned makes excellent casts for studying the burrows of underground insects. If properly thinned it will follow the burrow for about 6 ft. underground. In this way satisfactory studies may be made of the burrows of bees, wasps, spiders, and many Coleopterous insects.

The relation of insects to plants and the rôle of extra floral bracts, F. PLATEAU (*Mem. Soc. Zool., France, 11 (1898), No. 3, pp. 339-368*).—This paper is a study of the insect visitors of *Salvia horminum*, *Dianthus barbatus*, and *Hydrangea opuloides*.

Insect enemies of citrus trees, ALLEN, BLUDNO, FROGGATT, and GUTHRIE (*Agr. Gaz. New South Wales, 9 (1898), No. 10, pp. 1216-1221, pls. 4*).—The authors describe and suggest remedies for the following insect pests of citrus fruit trees: Orange butterfly (*Papilio erecthus*), orange borer (*Uracanthus cryptophaga*), *Monolepta rosæ*, fruit fly (*Tephritis tryoni*), bronze orange bug (*Oncoscelsis sulciventris*), green orange bug (*Rynchocorus* sp.), yellow cross bug (*Mictis symbolica*), orange aphis (*Siphonophora citrifolii*), fluted scale (*Icerya purchasi*), red scale (*Aspidiotus aurantii*), long scale (*Mytilaspis gloveri*), purple scale (*M. citricola*), white louse (*Chionaspis citri*), brown olive scale (*Lecanium oleæ*), Indian white wax scale (*Ceroplastis ceriferus*), and orange rust mite (*Phytoptus oleovorus*).

New, or little-known, Aleurodidæ, A. L. QUAINTANCE (*Canad. Ent., 31 (1899), No. 1, pp. 1-4, pl. 1, figs. 7*).—The author figures and describes the various phases of a new species to which the name *Aleurodes mori* is given. This insect is said to occur in great abundance on the leaves of mulberry at Tampa, Florida. It also is found in some abundance at Lake City on the leaves of various trees.

Bark beetles of Denmark, E. A. LOEVENDAL (*De Danske Barkbiller. Copenhagen, 1898; abs. in Forst. Naturw. Ztschr., 7 (1898), No. 12, pp. 448-450*).—Illustrated notes are given of about 50 species of Scolytidæ and Platypodidæ and the injury to the trees they attack.

The Cattleya fly, W. H. YOUNG (*Gard. Chron., 3. ser., 28 (1899), No. 620, p. 23, fig. 1*).—Notes are given of *Isosoma orchidearum*.

Notes on Coccidæ, with descriptions of new species, J. D. TINSLEY (*Canad. Ent., 30 (1898), No. 12, pp. 317-320, figs. 2*).—*Phenacoccus solenopsis* and *Dactylopius azaleæ* are described and notes given on other species.

New species of Coleoptera of the family Chrysomelidæ, with a short review of the tribe Chlamydini, M. L. LINELL (*Proc. U. S. Nat. Mus., 20 (1898), pp. 473-485*).—A monographic review is given of the above and the following new species described: *Megascelis texana*, *Lema longipennis*, *L. jacobina*, *L. lebioides*, *L. coloradensis*, *Chlamys arizonensis*, *Cryptocephalus pubicollis*, *Metachroma viticola*, *Plagiodera purpurea*, *Phyllobrotica nigritarsis*, *Diabrotica nitida*, *Haltica nigritula*, and *Crepidodera carinata*.

Two parasites of sugar cane, E. BORDAGE (*Rev. Agr. Reunion, 2 (1898), No. 9, pp. 400-403*).—Notes are given on *Dendroneura sacchari* and *Grapholitha schistaceana*, the grubs of which bore the sugar cane, causing considerable loss.

Notes on insects attacking dried fruit, seeds, etc., W. W. FROGGATT (*Agr. Gaz. New South Wales, 9 (1898), No. 10, pp. 1103-1105, pl. 1*).—Brief notes are given of *Ephestia elutella* in compressed vegetables, *Tenebroides mauretanicus* in wheat, and mites, probably *Tyroglyphus longoir*, in linseed meal.

The Hessian fly on timothy, J. FLETCHER (*Canad. Ent., 30 (1898), No. 12, p. 301*).—The author notes the presence of the puparia of the Hessian fly on specimens of timothy that grew in a badly infested wheat field on Prince Edward Island. The Hessian fly has been reported as attacking timothy in Russia, but the author believes this the first record in America.

Macrolepidoptera of early spring, A. J. NIELSEN (*Ent. Medd., 2. ser., 1 (1897), No. 1, pp. 38–43*).

Danish Lepidoptera, F. GUDMAN (*Ent. Medd., 2. ser., 1 (1897), No. 1, pp. 1–32*).

Descriptions of new Noctuids, J. B. SMITH (*Canad. Ent., 30 (1898), No. 12, pp. 321–326*).—The author describes the following new species: *Eutolype grandis, Hadenella lævigata, H. subjuncta, Lathosea ursina,* and *Pleroma bonuscula.* The first species is from Missouri, the others from Colorado.

Revision of the Orthopteran group Melanopli (Acridiidæ), with special reference to North American forms, S. H. SCUDDER, *Proc. U. S. Nat. Mus., 20 (1898), pp. 1–421, pls. 26*).—The following new genera with numerous species are figured and described: Gymnoscirtetes, Netrosoma, Phædrotettix, Conalcæa, Barytettix, Phaulotettix, Cephalotettix, Rhabdotettix, Cyclocercus, Sinaloa, Campylacantha, Eotettix, Æoloplus, Phœtaliates, Pœcilotettix, Œdaleonotus, Asemoplus, and Philocleon.

The earlier phases of Plusia æmula, H. HIRSCHKE (*Verhandl. K. K. Zool. Bot. Gesell. Wien, 48 (1898), No. 8, pp. 535, 536*).—The early stages in the life history of this insect are described. Its food is secured from low growing plants, such as Hieracium, Leontodon, Plantago, clovers, etc.

A new plant louse on tobacco, T. PERGANDE (*Canad. Ent., 30 (1898), No. 12, pp. 300, 301*).—Technical descriptions are given of *Nectarophora tabaci*, a new plant louse that feeds on tobacco. The insect has been under observation for more than a year, and in addition to tobacco it is said to occur on *Rumex crispus, Leucanthemum vulgare, Forsythia viridissima,* and on the leaves of the apple, pear, eggplant, and tomato.

Notes on the life history of Protoparce carolina, W. B. ALWOOD (*Science, n. ser., 8 (1898), No. 195, p. 400*).—The author states that in the vicinity of Blacksburg, Virginia, this species shows a tendency to be double brooded. The earliest moths appear June 7–12, oviposition begins June 20, the larvæ molt four times at intervals of about 4 days, become full-fed in 20 to 21 days, and enter the soil for pupation. A small part of the brood issues as adults the first year, but the greater part are single brooded and appear as adults in July after passing the winter as pupæ.

Classification of the suborder Phytophaga, W. H. ASHMEAD (*Canad. Ent., 30 (1898), No. 12, pp. 305–316*).—This is the concluding paper on this subject and deals with the families Tenthredinidæ and Cimbicidæ.

Sphærococcus in Massachusetts, T. D. A. COCKERELL and G. B. KING (*Canad. Ent., 30 (1898), No. 12, p. 326*).—*Sphærococcus sylvestris* n. sp. is described on the white oak in Massachusetts. It is closely related to *S. parvus*, but may be distinguished by its better-developed antennæ.

The life history of Tortrix resinella, M. BÜSGEN (*Allg. Forst u. Jagd Ztg., 74 (1898), No. 12, pp. 380–383*).

American leaf hoppers of the subfamily Typhlocybinæ, C. P. GILLETTE (*Proc. U. S. Nat. Mus., 20 (1898), pp. 709–773*).—A monographic review is given of the above and the following new species described: *Alebra curvilinea, A. bifasciata, A. trimaculata, A. robusta, A. dorsalis, A. fumida, Dicraneura maculata, D. cruentata, D. unipuncta, D. communis, D. quadrivittata, Empoasca trifasciata, E. livingstonii, E. unicolor, E. splendida, E. albolinea, E. denticula, E. pergandei, E. incisa, E. atrolabes, E. mexicana, E. radiata, E. robusta, E. pallida, E. snowi, E. alboneura, E. tumida, Eupteryx vanduzei, E. flavoscuta, Typhlocyba bipunctata, T. tunicarubra, T. hartii, T. rubroscuta, T. illinoiensis, T. dentata,* and *T. crevecœuri.*

Colorado's worst insect pests and their remedies, C. P. GILLETTE (*Colorado Sta. Bul. 47, pp. 64, figs. 54*).—The author gives popular descriptions and suggests methods for the destruction of the principal insect enemies of the apple, pear, plum, peach, and cherry trees; small fruits; roses; shade trees; farm and garden crops; grain insects and household pests. A number of insecticides are described, their methods of preparation and use being given in considerable detail.

The Coccidæ of Kansas, S. J. HUNTER (*Kansas Univ. Quart., 8 (1899), No. 1, pp. 1–15, pl. 1*).—Critical notes and descriptions of new species.

Odor of the San José scale, F. M. WEBSTER (*Canad. Ent., 31 (1899), No. 1, p. 4*).—Attention is called to the odor which is associated with *Aspidiotus perniciosus* by which, in cases of considerable abundance, the scale can be detected at a considerable distance. When the air is quiet it is often possible to detect the presence of a badly infested tree at a distance of a yard or more. The author comments on the possession of this odor and states that possibly in its native home this may attract insects and afford means of diffusion which are not present in this country.

A new danger to fruit growers, L. R. TAFT (*Michigan Sta. Spec. Bul. 7, pp. 3*).—Attention is directed to the San José scale and the growers are warned against its attacks.

Summer treatment for the San José scale, W. B. ALWOOD (*Virginia Sta. Bul. 74, pp. 28–34, figs. 3*).—This records data obtained in the use of pure kerosene against the San José scale since the publication of Bulletin 72 of the station (E. S. R., 9, p. 1067). Instances are noted in which kerosene proved very injurious to the trees, but in many cases no serious injury was noted, even when trees were in flower at the time of spraying. In regard to the use of kerosene the author says:

"The foregoing abstracts and unpublished matter in the records of the work now in progress show that pure kerosene can be safely used upon all our fruit trees in the dormant season and with proper precautions during the growing season also. The chief point to be observed in its application is the proper atomization of the kerosene. Unless it be applied in a finely atomized condition, and in quantity so as to just moisten the parts of the plant there is danger. The skill and judgment necessary to insure safety in this work are not such as to preclude the use of kerosene by fruit growers, hence in the light of the above and other unpublished experiments, I recommend it as a summer treatment for San José scale. I believe it to be the treatment *par excellence*, as in every case where I have used it on this scale it has destroyed them with great certainty. It is too soon to make an absolute statement as to the degree of efficacy, but the experiments now under way will furnish much data on this point by the end of the season."

Three forms of apparatus for spraying kerosene are figured and briefly discussed. Some form of blast atomizer is thought to be best.

Hydrocyanic-acid gas fumigation, A. F. WOODS (*Florists' Exchange, 10 (1898), No. 49, p. 1146*).—Reports on tests made to observe the effect of weak doses of hydrocyanic-acid gas for long periods on greenhouse plants in large houses. It was found that any dose weaker than 0.15 gm. of 98 per cent cyanid per cubic foot of space in the house for 20 minutes was ineffectual.

Fumigation of fruit with hydrocyanic acid, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 9 (1898), No. 10, p. 1191*).—Oranges, lemons, and apples were placed in a small chamber and treated for 3 hours with vapor of hydrocyanic gas. After exposing the fruit in the open air for half an hour no trace of the acid could be detected in the flesh or outer skin of the fruit by smell, taste, or chemical examination. No live scale remained.

Legislation for the suppression of the San José scale, W. B. ALWOOD (*Virginia Sta. Bul. 74, pp. 21–28*).—The law of Virginia relating to the San José scale is given, together with comments by the author of the bulletin. The lines of work to be followed under the law are pointed out.

FOODS—ANIMAL PRODUCTION.

On the relative digestibility of white and brown [whole wheat] bread, T. L. BRUNTON and F. W. TUNNICLIFFE (*St. Bartholomew's Hospital Rpts., 33 (1897), pp. 157–168*).—The authors report an extended

study of the composition and digestibility of white and whole-wheat bread. The composition of the two sorts of bread was as follows:

Composition of white and whole-wheat bread.

	White bread.	Whole-wheat bread.
	Per cent.	*Per cent.*
Water	39.10	40.18
Dry substance	60.90	59.82
Total ash	.59	1.88
Phosphoric acid	.16	.51
Soluble matter	4.73	7.54
Nitrogen	1.32	1.25
Albumen, calculated from nitrogen	8.25	7.87
Pure albumen	7.34	7.86
Soluble nitrogenous matter	.61	.73
Starch and saccharine matters, etc	51.85	49.44
Starch	38.45	39.18
Sugar (maltose)	1.19	1.77
Dextrin	.84	.71
Cellulose	.24	1.06
Fat	.21	.63
Acidity (lactic acid)	.19	.29
Loss of water in fifteen days	9.23	....

Artificial digestion experiments were made with mixed saliva and Benger's liquor pancreaticus and liquor pepticus. The principal deductions from the experiments, which are discussed in detail, follow:

"From the experiments we are justified in concluding that the higher nutritive value which we might, upon pure chemical grounds, ascribe to brown bread, can not, with the single exception of fats and mineral constituents, be maintained from the physiological side. On the other hand, distincty less of the nutritive materials actually get into the blood in the case of brown than of white bread. . . .

"White bread is, weight for weight, more nutritious than brown. Therefore it appears the preference given by operators in large towns for white bread has, to a certain extent, a sound physiological basis.

"In the case of people with irritable intestines, white bread is to be preferred to brown.

"In the case of people with sluggish intestines, brown bread is preferable to white, as it tends to maintain regular peristaltic action, and insure regular evacuation of the bowels, with all its attendant advantages.

"In cases where the proportion of mineral ingredients, and especially of lime salts, in other articles of food or drink is insufficient, brown bread is preferable to white. . . .

"If the dietary is insufficient in fat, or if the patient is unable readily to digest fat in other forms, brown bread may possibly be preferable to white."

The use of molasses in feeding animals, D. DICKSON and L. MALPEAUX (*Ann. Agron.*, *24* (*1898*), *No. 8*, *pp. 353–381*).—Experiments on the value of molasses as part of a ration are reported with sheep, pigs, steers, milch cows, and horses. The principal conclusions follow: When molasses formed part of the ration of sheep, pigs, and steers the gains in live weight were rapid. When molasses was fed to milch cows the total milk yield and the amount of fat and milk sugar in the milk was increased. The increase is not regarded as sufficient to warrant the conclusion that molasses is a suitable food for milch cows. Molasses is regarded as an excellent food for horses. It was readily eaten and vigor and weight were maintained when it was added to the

ration. Molasses may be advantageously employed for rendering inferior hay or fodder more palatable.

Bullock-feeding experiment, T. B. WOOD (*Cambridge and Counties Agr. Education Scheme, Field and Feeding Experiments, Rpt. 1897, pp. 44–52*).—Brief reference is made to feeding experiments with sheep and steers carried on in previous years at Whitlingham, Norfolk. In the winter of 1896–97 a test was made with 4 lots of 5 steers each, to compare linseed cake and the following grain mixtures: Linseed cake and common cotton-seed cake; decorticated cotton-seed cake and maize meal; and decorticated cotton-seed cake, common cotton-seed cake, maize meal, and dried grains. In addition to the grain the steers were given 10 lbs. of mixed chaff and 112 lbs. of roots per head daily. The average weekly gains per head of the 4 lots was 16.7 lbs., 13.9 lbs., 14.0 lbs., and 15.2 lbs. The net profits were from $3.60 to $4.86 per head. Making allowance for the manurial value of the food, linseed cake gave slightly the best results. Few details of this test are given.

In 1897–98 a similar test was made with 4 lots of 5 steers each. Lot 1 was fed linseed cake; lot 2, linseed cake and common cotton-seed cake, 1:1; lot 3, decorticated cotton-seed cake and dried brewers' grains, 1:1; and lot 4, linseed cake, common cotton-seed cake, and maize meal, 1:1:1. At the beginning of the test the steers were fed per head daily 6 lbs. of the grain ration. After about a month the ration was increased to 8 lbs. and later to 10 lbs. In addition the steers were fed 10 lbs. cut (chaffed) hay and straw mixed and 112 lbs. of roots per head daily. The test began December 13 and continued until the steers were judged ready for slaughtering. One steer from each lot was sold and slaughtered March 15, March 16, April 18, April 25, and May 3. The average weekly gain per head of the 4 lots was 11.9 lbs., 10.6 lbs., 9.3 lbs., and 10.5 lbs., respectively. The gains of the steers of the different lots and the cost of gains are discussed in detail, the results being compared with the test made in the previous year.

"Summarizing the 2 years' results, the 2 experiments have agreed very well, and it appears clear that linseed cake alone is the most profitable food to purchase for fattening steers, though it has been very closely followed in each experiment by the mixture of linseed cake, common cotton cake, and dried grains, with or without maize meal. Linseed cake and common cotton cake mixed have always paid the least, but it is worthy of notice that the steers eating this mixture have always started well, and have only lost ground later in the period of feeding. This suggests that in future experiments one lot should be started on linseed cake and common cotton cake, half and half, for the first month, after which the proportion of linseed cake should be raised, until the steers finished up the last month on linseed cake only. This ration would probably compare favorably from an economical point of view with cake alone all the time."

Rape for lambs, J. A. CRAIG (*Wisconsin Sta. Rpt. 1897, pp. 72–79, fig. 1*).—The author quotes at some length experiments on the value of rape for fattening lambs, which were previously reported (E. S. R., 8, p. 327). The value of rape for lambs previous to fattening was tested in 1896 with 2 lots of 48 lambs. The lambs were dipped and tagged, and after a preliminary period of 2 weeks the test proper began October 12. It was divided into 2 periods of 4 and 12 weeks. Lot 1 was

fed rape and lot 2 was given the range of a blue-grass pasture. In addition both lots were fed a mixture of peas and corn 1:1. At the beginning of the test lot 1 weighed 3,022.5 lbs. and lot 2, 3,232.5 lbs. The gains made by the 2 lots were 501 and 325 lbs. respectively. Lot 2 was fed the rape from 0.64 acre. Each lot consumed 878 lbs. of the grain mixture. During the second period both lots were fed in sheds, and given similar rations, consisting of hay and a mixture of corn and peas 1:1, the object being to compare the influence of the previous pasturing on fattening. Lot 1 gained 952 lbs. and lot 2, 858 lbs. Each lot consumed 4,084 lbs. of grain. Lot 1 consumed 2,488 lbs. of hay and lot 2 2,703.5, a difference of 215.5 lbs. in favor of lot 1.

"From the results it will be seen that when the 2 lots were put in pens and fed similar rations, lot 1 that had rape instead of pasture made a greater gain than the other lot, and they also ate less hay, thus showing the beneficial influence of pasturing lambs on rape in the fall previous to fattening them."

Grain for lambs before weaning, J. A. CRAIG (*Wisconsin Sta. Rpt. 1897, pp. 37–41*).—The author quotes earlier work (E. S. R., 8, p. 714), and reports additional tests of the value of grain before and after weaning. In 1896 a test was made of 4 lots of 6 lambs to compare corn meal, oats, bran, and cracked peas. The test began April 14 and covered 12 weeks before weaning. Three ewes ran with the lambs in each lot and were given the same rations as the lambs mentioned below. The financial statement is based on oats at 20 cts., corn at 30 cts., and peas at 45 cts. per bushel, and bran at $13 per ton. The results are summarized in the following table:

Results of feeding grain to lambs before weaning in 1896.

Lot.	Food.	Weight at beginning.	Total gain.	Food eaten per pound of gain.	Cost of food per pound of gain.
		Pounds.	*Pounds.*	*Pound.*	*Cent.*
1	Ground corn	153.0	297.5	0.19	0.10
2	Whole oats	145.5	298.5	.68	.40
3	Bran	144.0	307.5	.20	.12
4	Cracked peas	145.5	298.0	.75	.52

In 1897 a test was made with 4 lots of 6 Shropshire grade lambs, 3 ewes running with each lot. The test covered the 10 weeks previous to weaning. The conditions of the experiment were the same as in the preceding test. The results were as follows:

Results of feeding grain to lambs before weaning in 1897.

Lot.	Food.	Weight at beginning.	Total gain.	Food eaten per pound of gain.	Cost of food per pound of gain.
		Pounds.	*Pounds.*	*Pound.*	*Cent.*
1	Ground corn	314.0	214.5	0.55	0.27
2	Whole oats	316.0	211.5	.51	.30
3	Bran	299.5	181.0	.53	.31
4	Cracked peas	307.0	188.0	.69	.48

From these tests and that previously reported the general deductions are drawn that—

"The ground corn gave the best results as far as cost of gain is concerned, and next to it ranks bran, while oats and peas are shown to be of equal value. . . . The trials show that for feeding lambs when they are suckling their dams these foods should be chosen in the following order: First, ground corn; second, bran; third, oats or cracked peas."

Grain mixture for lambs before and after weaning, J. A. CRAIG (*Wisconsin Sta. Rpt. 1897, pp. 42–44*).—The comparative value of corn and a mixture of corn with other grains was tested with 15 lambs before and after weaning. They were divided into 3 lots of 5 each. There were 3 ewes with the lambs in each lot. Lot 1 was fed ground corn, lot 2 corn and oats, and lot 3 ground corn and cracked peas. The lambs were fed all the grain they would eat morning and evening, and during the day were with their dams on ordinary blue-grass pasture. The test covered 8 weeks before and 8 weeks after weaning. The weight of the lots at the beginning of the test was as follows: Lot 1, 291.5 lbs.; lot 2, 299.5 lbs.; and lot 3, 288 lbs. In 8 weeks the 3 lots had gained 139, 139.5, and 139 lbs., consuming 0.26, 0.31, and 0.42 lb. of grain, respectively, per pound of gain. In each case the corresponding cost of gain was 0.13, 0.17, and 0.24 ct. During 8 weeks immediately after weaning lot 1 gained 95, lot 2, 92.5, and lot 3, 98 lbs., consuming 0.13, 0.14, and 0.13 lb. of grain per pound of gain, respectively, the cost of gain being 0.6, 0.7, and 0.7 ct. per pound.

"The outcome of this trial still maintains the position of ground corn as a food for lambs, though the results are practically the same from the lambs in all of the lots. The lot getting the corn and peas gained slightly the most, and they ate more grain than the others, but in respect to the cost of the gain the ground corn maintains its position.

"The mixture of corn and peas, however, seems to be a ration that the lambs relish as they grow older, but previous to weaning none of these mixtures seem to give as satisfactory results as the ground corn. It is a fact, however, that in feeding such a ration as ground corn alone there is likely to be more sickness among the lambs than if they have a mixed ration. Aside from this the addition of oats or peas to the ration of unground corn produced no appreciable benefit, while it increased the cost in every instance."

Lambs for early spring market, J. A. CRAIG (*Wisconsin Sta. Rpt. 1897, pp. 45–49, figs. 4*).—The lambs raised at the station are mostly a cross of a pure-bred Dorset ram on Shropshire grade ewes. There are also some second-cross lambs; that is, lambs from a crossing of a pure-bred Dorset ram on the cross-bred ewes mentioned above. The author gives in tabular form the number and cross of the ewe, date of service, date of lambing, number of lambs, date when sold, and the weight and value of the lambs in the station flock.

"From our experience in trying to establish a flock for breeding early lambs, we can say that a reasonable degree of success may be attained as soon as the first-cross ewes are ready to be bred, but it is equally clear that a greater certainty of breeding the ewes early exists where the ewes are the second cross of the Dorset on native sheep."

Experiments in sheep fattening, J. GRUDE (*Aarsber. Offent. Foranst. Fremme, 1897, pp. 282–290*).—The tests were conducted on the same general plan as the earlier experiments carried on by the author with government aid (E. S. R., 5, p. 919; 8, p. 154; 9, p. 1075). The following table shows the principal results:

Results of sheep-feeding experiments, 1897.

	Number of animals.	Average age.	Average length of fattening period.	Feed per day per 1,000 kg. live weight.				Live weight.		Increase in live weight.
				Hay.	Turnips.	Linseed oilcake	Oats.	At beginning.	At end.	
		Years.	*Days.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Per ct.*
Wethers	70	$1\frac{1}{2}$	30	7.6	75.6	16.2	5.4	44.1	50.7	15.0
Do	50	$2\frac{1}{2}$	30	7.0	79.1	15.6	4.1	49.2	57.2	16.3
Ewes	70	$1\frac{1}{2}$	30	8.0	74.8	16.6	5.1	41.9	48.6	16.0
Do	50	$2\frac{1}{2}$	30	7.6	82.8	16.9	4.4	44.2	50.7	12.9
Wethers	70	$1\frac{3}{4}$	30	10.3	70.9	14.7	6.0	44.2	48.6	9.8
Lambs	70	$\frac{3}{4}$	30	10.3	72.5	15.0	6.4	31.2	34.7	10.3
Totals and averages	380	....	30	8.5	75.6	15.8	5.3	42.0	47.8	13.9

—F. W. WOLL.

Establishing a flock of mutton sheep, J. A. CRAIG (*Wisconsin Sta. Rpt. 1897, pp. 50–55, figs. 3*).—The author discusses the requirements for a flock of mutton sheep. The most important considerations in his opinion are good rams and ewes that are deep milkers and suckle their lambs well and have the densest fleeces for their own protection.

"It matters little if a ewe is not as nicely rounded in form as she might be. If she is a good milker, she deserves the premier position in the flock. . . . The feeding of the ewe lambs that are to furnish the new material for the flock should be liberal in every sense of the word. Feed them liberally on oats and see that they get the best pasturage that it is possible to secure for them, and it will be found surprising how lusty they will grow during the first 9 months of their lives."

Uniformity in the lambs raised is deemed an important requisite.

"To secure this it should be an axiom for every flock master to never sell or dispose of a ram that proves to be a valuable breeder as well as a getter of superior lambs. Such a ram should be permanently retained at the head of the flock, and bred to the same ewes year after year as long as it is possible to do so."

Whole corn compared with corn meal for pig feeding, W. A. HENRY (*Wisconsin Sta. Rpt. 1897, pp. 29–36*).—The author quotes in some detail 2 experiments in 1896 on this subject (E. S. R., 9, p. 580), and reports 2 additional experiments made in 1897. The first trial in 1897 was with 2 lots of 9 Poland China-Chester White pigs each. They were all straight bodied, strong boned, and well built, with vigorous constitutions. They had been pastured on rape or grass and given grain, and were in rather high condition at the beginning of the trial. Lot 1 was fed a ration consisting of shelled corn and wheat middlings 2:1. The shelled corn was fed in a trough and when consumed the wheat middlings was fed mixed with water. Lot 2 was fed corn meal and wheat middlings 2:1. The test covered 12 weeks. Lot 1 weighed 1,907

lbs. at the beginning of the trial and gained 984 lbs., consuming 4.42 lbs. of grain per pound of gain. Lot 2 weighed 1,886 lbs. at the beginning of the test, gained 1,348 lbs., and consumed 5.01 lbs. of grain per pound of gain. In the author's opinion the amount of feed required per pound of gain is reasonable considering the good condition of the pigs at the beginning of the trial.

The second test was made with 2 lots of 7 pure-bred Poland Chinas and cross-bred Poland China Berkshires. "They were of fine bone with round bodies and much more delicate than the preceding lot. They showed in strong contrast with those of the first trial the difference between pigs of good bone and constitution and those too much refined by high breeding." These pigs had likewise been pastured on rape or grass before beginning the test, which covered 9 weeks. In other respects the conditions were the same as in the preceding trial. Lot 1 weighed 1,281 lbs. at the beginning of the trial and gained 552 lbs., consuming 4.62 lbs. of grain per pound of gain. Lot 2 weighed 1,383 lbs. at the beginning of the trial and gained 576 lbs., consuming 4.24 lbs. of grain per pound of gain. The gains made at different periods of the test are discussed and the results of these trials are compared with those of earlier tests.

"The gains were greatest during the first weeks of the trial and lightest during the last weeks. On the contrary, more feed was eaten during the last weeks of the trial than in the beginning. Coming to the feed required per pound of gain, the results obtained in the earlier stages stand in strong contrast with those obtained near the close. For the first week 3.62 lbs. of feed made 1 lb. of gain, while in the twelfth week 5.98 lbs. were required.

"Grouping the results into four-week periods in order to secure better averages . . . we see that during the first period of 4 weeks, 4.18 lbs. of feed made 1 lb. of gain; during the second four-weeks period 4.61 lbs. were required; and during the last four weeks 5.59 lbs. of feed were required per pound of gain."

Data concerning sow and pigs at farrowing time, W. A. HENRY (*Wisconsin Sta. Rpt. 1897, pp. 8, 9*).—A number of observations were made in the spring of 1897 on pure-bred Poland China and Berkshire pigs or crosses of these breeds, and upon cross-bred Poland Chinas and Chester Whites. The sows ranged from 1 to 4 years in age and from 240 to 577 lbs. in weight. They were weighed several hours before and several hours after farrowing and the pigs were also weighed. The average weight of the sows before farrowing was 382.1 lbs. and after farrowing 359 lbs. The average weight of the afterbirth was 4.01 lbs.

"The litters averaged 16.7 lbs. each, the individual pigs ranging in weight from 1.3 to 3.1 lbs., the average being 2.2 lbs. In general, the individual pigs in large litters are somewhat smaller than those of small litters.

"Frequently in a litter of pigs there is one member much weaker than the others, and this is styled the 'runt' or 'teatman.' It is sometimes spoken of as the last pig farrowed, this occurrence seeming in some unknown way to mark its inferiority. [The observations made showed that] the last pig farrowed was not necessarily of lighter weight than the others, and the observer noted no weakness or other mark indicating inferiority in any way."

The cost of feeding pigs before and after weaning, W. A. HENRY (*Wisconsin Sta. Rpt. 1897, pp. 20–28*).—Tests were made with 5 sows and their litters, to compare the cost of feeding before and after weaning. There were 6 pigs with sow 1, 6 with sow 2, 7 with sow 3, 9 with sow 4, and 12 with sow 5. All the lots were fed equal parts by weight of a mixture of corn meal, middlings, and skim milk 1:1:4. The milk was generally sour. Water was supplied in addition. When very young the pigs were given no food except milk supplied by the sows. As they increased in size they were encouraged to eat the ration mentioned above, which was placed before them in a separate trough 3 times daily. The pigs were weaned when 70 days old, and the feeding continued for 49 days after weaning, the pigs being fed all they would eat without waste. On the other hand, the sows, having gained in weight while suckling the pigs, were given a limited quantity of food, in order that they might not make too much gain. The tests are reported in detail in tabular form. The results are summarized in the following table, which shows the food required per pound of gain by both sows and pigs before weaning and by each after weaning:

Average of results with sows and pigs before and after weaning.

	Feed required per pound of gain.	
	Meal.	Milk.
	Pounds.	*Pounds.*
Sows and pigs before weaning	2.37	4.75
Pigs after weaning	2.88	5.76
Sows after weaning	7.10	14.20

On the supposition that 6 lbs. of separator skim milk is the equivalent of 1 lb. of meal, the author calculates that the sows and pigs before weaning required food equivalent to 3.16 lbs. of meal per pound of gain, and the pigs after weaning the equivalent of 3.84 lbs. of meal.

"In these figures we have another illustration of how much more economical young pigs are than more mature animals in the feed required for a given gain. When these same pigs have reached a weight of 300 lbs., about 500 lbs. of grain will be required for 100 lbs. of gain.

"A large amount of feed was required by the sows for 100 lbs. of gain after their pigs had been weaned; the explanation of this is simple. These sows had usually gained in weight while suckling their pigs and were therefore in good flesh. Being required for future breeders, we did not wish them to become too fat, a condition which they would readily attain, had sufficient feed been supplied. These figures afford an excellent illustration of how unprofitable it is to supply animals with less feed than they can readily consume when gain in weight is the end desired. These sows require nearly three times as much feed for 100 lbs. of gain as did their pigs which had just been weaned from them. This is because the herdsman gave them a very limited quantity of nutrients, only about what they required for maintenance, his object being not to allow them to materially gain in flesh."

Peat molasses for horses, H. GOLDSMITH (*Ugeskr. Landm., 43 (1898), No. 23–24, pp. 291, 292, 306–309*).—The peat molasses fed in this experiment was manufactured from beet molasses and dry peat in the propor-

tion of 4:1. Chemical analysis by V. Stein showed it to contain: Water, 23.80 per cent; protein, 9.31 per cent; fat, 0.23 per cent; carbohydrates, 52.60 per cent (sugar, 40.1 per cent); crude fiber, 3.75 per cent; ash, 10.31 per cent.

Twenty street-car horses were included in the experiment, which was continued for about 4½ months (December 20–May 2). The regular grain ration of the horses consisted of 11 lbs. of oats, 5.5 lbs. corn, 1.65 lbs. wheat bran, 0.55 lbs. rye bread. For 15 of the horses 3.3 lbs. of this mixture was replaced by 3.3 lbs. of peat molasses, and after 2 months 2.2 lbs. were again replaced by 2.2 lbs. of peat molasses. The remaining 5 horses formed a control lot and were fed the regular grain ration during the entire experiment. The health of the horses and their capacity for work were satisfactory throughout the test. The average weight of the horses fed peat molasses at the beginning of the test was 1,226.5 lbs.; at the end of the first period there was a loss of 25.3 lbs.; at the end of the second period a gain of 8.8 lbs. Considering the experiment as a whole there was a loss of 23.1 lbs. The average weight of the horses fed grain at the beginning was 1,298 lbs.; at the end of the first period there was a loss of 14.3 lbs.; at the end of the second period there was a loss of 16.5 lbs. During the whole test there was a loss of 34.1 lbs.

While 3.3 lbs. of peat molasses could not quite take the place of 3.3 lbs. of grain feed in the experiment, it will be noticed that 2.2 lbs. of the molasses feed under the conditions present had a higher nutritive effect than the same weight of grain feed. Considering the average results obtained for both periods the peat molasses proved somewhat superior to the oats and corn. The experiment indicates that a few pounds of peat molasses may be fed daily to horses with advantage, if this feed is cheaper, pound for pound, than common concentrated horse feeds. The decrease in weight of the experimental horses is in accordance with general experience, as horses regularly fall off in weight during the spring (according to the author, about 16.5 lbs. per head).—F. W. WOLL.

The distribution of gluten and its constituents in the starch layer of wheat, E. FLEURENT (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 22, pp. 1592–1595*).—The gluten in the flour at different stages of grinding and the amount of glutenin and gliadin in the gluten are reported in several sorts of wheat. The results, in the author's opinion, show that the gluten content and the composition of the gluten varies in different varieties of wheat and in the products obtained from the same wheat at different stages of grinding. The quantity of gluten increases from the center toward the periphery of the starch layer and the gluten contains a higher percentage of glutenin as it approaches the interior of the grain.

Nuts as food in foreign countries (*U. S. Consular Rpts., 1898, No. 219, pp. 537–548*).—These articles, prepared by the consuls to the various countries, describe the nuts used as food in France, Italy, Korea, and Syria. In France these were chestnuts, almonds, and peanuts; in Italy, almonds, filberts, chestnuts, pistachios, walnuts, and pine nuts; in Korea, chestnuts, walnuts, pine nuts, peanuts, and jinko nuts; in Syria, chestnuts, filberts, pine nuts, pistachios, and walnuts. In several cases statistics of the amount consumed are given together with methods of cultivation, etc.

The composition of Ohio wines, A. W. SMITH and N. PARKS (*Jour. Amer. Chem. Soc., 20 (1898), No. 11, pp. 878-882*).—Analyses are given of wine made by the authors from 12 varieties of grapes grown in Ohio, and of a number of typical samples of wines sold in northern Ohio. The Ohio wines were 1 year old, except 2 samples which were 2 years old. The results are compared with European analyses and standards, and the application of the results in determining cases of adulteration is pointed out.

Michigan Dairy and Food Commission Bulletin 40 (*pp. 43*).—A report is given of the examination of a considerable number of samples of spices, imitation fruit jelly, oleomargarin, etc., together with a résumé of the Dairy and Food Commission's operations for the 6 months ending December 31, 1898.

Publications of the institute of hygiene of the University of Padua (*Pubblicazioni Dell 'Istituto D'Igiene Della R. Università Di Padova. Padua: P. Prosperini, 1898, p. 344, maps 2*).—This volume (which is made up of separates with an introduction) contains the investigations which have been conducted by Prof. A. Serafini, or by his students under his direction. Some of these have already been noted in the Record (E. S. R., 9, pp. 265, 266).

Rules for the management of the Bengal Institute Hostel and scale of dietary studies for each student, F. RAYMOND (*Ann. Rpt. Civ. Vet. Dept. [Bengal], 1897-98, Append. 21-22, pp. 14-16*).—The kinds and amount of food consumed per man per day in the students' boarding club and its cost are briefly recorded.

Annual report of the live stock breeders' assoications (*Rpts. Live Stock Assocs. Province of Ontario, 1897-98, pp. 142*).—This contains the usual addresses and reports and, in addition, the following papers: Tuberculosis in cattle, D. McCrae; The requirements of the home and foreign mutton and wool markets, M. Levering; Shorthorn prospects, R. Gibson; Broad-minded breeders, W. Linton; Beef breeds and their value, J. I. Hobson; Care and application of manure, J. Yuill; and The Ayrshire and its uses, J. C. Smith.

A digest of metabolism experiments, W. O. ATWATER and C. F. LANGWORTHY (*U. S. Dept. Agr., Office of Experiment Stations Bul. 45, rev. ed., pp. 434*).—A number of errors in the figures in the tables have been corrected.

Analyses of cakes used in bullock-feeding experiments, T. B. WOOD (*Cambridge and Counties Agr. Education Scheme, Field and Feeding Expts., Rpt. 1897, p. 53*).—Analyses of the composition of the cakes used in steer feeding experiments stated above (p. 773), are reported.

The fattening of cattle, J. W. ROBERTSON (*Rpt. Comr. Agr. and Dairying, Canada, 1897, pt. 4, pp. 23-30*).—These tests have been noted from another source (E. S. R., 6, p. 450; 8, p. 916).

Calf raising, J. MASWERSIT (*Fühling's Landw. Ztg., 47 (1898), No. 24, pp. 918-920*).—The author reports the successful use of starch and skim milk as a food for calves.

Experiments to determine the effect of pea meal and sunflower-seed cake on the quality of fat, flesh, and wool of sheep, RAMM (*Deut. Landw. Presse, 25 (1898), No. 80, p. 855; 81, p. 864, figs.; 82, pp. 875, 876; 84, pp. 895, 896*).—Tests were made with 4 lots of 3 sheep each. Lots 1 and 3 were Merinos; lots 2 and 4, English sheep. Lots 1 and 2 were given sunflower-seed cake and lots 3 and 4, pea meal. The principal conclusions follow:

The Merino sheep made 10 per cent higher gains than the English sheep. Disregarding the belly fat, the results of slaughter tests of the breeds were about the same. The English sheep, however, had more belly fat and, in general, fatter carcasses. The solidifying point of the Merino fat was several degrees lower than that of the fat in the English sheep. The Merino sheep produced more wool than the others; the wool contained about twice as much wool fat; and the melting point of the wool fat was about 2½ per cent higher than that of the wool of the English sheep. The gains made with pea meal were about 2.2 per cent better, and the results of slaughter tests were also about 6.54 per cent better than in the case of the sunflower-seed cake. The sheep fed pea meal showed more belly fat, the flesh contained more dry matter, and more nitrogen. The fat had a much lower iodin value. The sheep fed sunflower-seed cake weighed more shorn and the wool contained more fat. The melting point of the wool fat was, however, 4.2 per cent lower.

Molasses as a feed for swine, G. FAYE and E. FREDERIKSEN (*Ugeskr. Landm., 43 (1898), No. 11, pp. 134–139*).—Forty pigs were divided into 2 lots of 20 each, one lot was fed Indian corn and the other barley. In each case molasses feed was substituted for one-third of the grain ration of part of the pigs.

The test covered 140 days. The results are expressed in full in tabular form. The test indicates that beet molasses when it is not fed too heavily, is an economical food for swine, its feeding value being equal to about three-fourths of that of grain feeds, pound for pound.—F. W. WOLL.

Rape for swine, J. A. CRAIG (*Wisconsin Sta. Rpt. 1897, pp. 80, 81*).—The tests were reported in a previous publication (E. S. R., 9, p. 374).

Concerning horse raising in Denmark, S. VON NATHUSIUS (*Fühling's Landw. Ztg., 47 (1898), No. 22, pp. 834–840; 23, pp. 865–870*).—The author visited Denmark and gives his opinion of horses and horse raising in that country in some detail.

The duration of a horse's life and the limits of his usefulness for work and breeding purposes, ZÜRN (*Fühling's Landw. Ztg., 47 (1898), No. 24, pp. 929–931*).—The author quotes many instances which are believed to be authentic of horses which have lived to an extreme age and many of them have been useful as draft animals and for breeding purposes.

DAIRY FARMING—DAIRYING.

Variations in milk and milk production, E. DAVENPORT and W. J. FRASER (*Illinois Sta. Bul. 51, pp. 77–104, dgm. 1*).—This is a record for 2 high-grade Jerseys, 2 registered Holsteins, and 1 high-grade Holstein. All were given similar care and feed. The fat was determined by the Babcock test and the solids-not-fat were calculated from the lactometer reading. The data were recorded for each of the 5 cows separately for each milking. A complete record for all 5 cows for 1 month and of 1 cow for 10 months is given in tables. The records of all the cows for 3 months were compiled and the results are presented and discussed. The yield and quality of the milk at the beginning and near the close of the period of lactation was also considered. A diagram is given showing the daily feed consumed and the yield of milk and fat for 2 cows for a period of 4 months. The authors' deductions from the record are as follows:

"The yield of milk from different cows under the same conditions differs greatly, and that from the same cow varies widely from day to day.

"The composition of milk is highly variable; the ratio of fat to other solids, and that of solids to water, is not constant as between different cows or for the same cow on successive days.

"The percentage of fat, or of other solids, is not always highest in the smaller yields, but cows that give milk with a high percentage of solids generally show a low total yield.

"Fat is the most variable constituent of milk, and its variations are independent of those of the other solids; therefore the yield of milk is a better index of the other solids than it is of the fat.

"As regards the first and last milk drawn, the proportion of solids-not-fat is higher in the first, but the proportion of fat is decidedly greater in the last.

"When the milking periods are unequal the longer period will generally, though not always, give the larger yield of milk, of fat, and of solids-not-fat; but the difference in yield does not correspond to the difference in time; that is, the secretion calculated per hour is greater during the shorter period.

"Neither daytime nor nighttime is shown to be superior as a milk-producing period.

"Different cows differ in their power to make milk from food, and the same cow varies in this respect from time to time.

"It pays to select the individual according to her power to manufacture milk from food, and according to the character of the product.

"Aside from the influence of food or environment each animal exhibits individual variations of her own, and such variations tend to show something like periodicity in the separate functional activities of the animal body."

Test of the Guernsey cow Suke of Rosendale (6520 G. H. B.) F. W. WOLL (*Wisconsin Sta. Rpt. 1897, pp. 153–160, fig. 1*).—A test of this cow for one week just after calving by one of the owners "shows a total production of 189.7 lbs. of milk and 14.98 lbs. of butter fat, making the average fat content of the milk produced during the week 7.90 per cent." For the purpose of studying the quality of the milk during the progress of lactation, samples were sent to the station on the 20th to 21st of each month during the winter, spring, and summer until the cow was dried off. The methods of analysis employed are described and the results of this study are tabulated, together with a summary of the yield and butter fat during 4 previous periods of lactation. The milk at no time during the test equaled in fat content that shown in the preliminary test of one week, indicating "that the high percentages of fat in the milk shortly after calving were due to abnormal conditions in the cow at the time." During the 285 days of the test the cow produced 5,490.7 lbs. of milk with an average fat content of 5.78 per cent, the total yield of fat being 317.28 lbs., an average of 1.11 lbs. per day.

A new proteid constituent of milk, A. WRÓBLEWSKI (*Ztschr. Physiol. Chem., 26 (1898), No. 3–4, pp. 308–313*).—The author finds that besides casein, albumin, and globulin, milk contains a fourth proteid, which he calls opalisin, on account of the opalescence of its solutions. The new proteid is obtained by precipitating the casein with acetic acid, and then saturating the curd with either magnesium sulphate, ammonium sulphate, or common salt. This precipitate differs from casein by not leaving any residue of pseudonuclein on digestion with pepsin. A neutral solution of the precipitate treated with a few drops of calcium chlorid and considerable phosphoric acid solution gives a precipitate of the opalisin.

It is present in considerable quantity in human milk, less in mares' milk, and in very small quantity in cows' milk. This constitutes another difference between human milk and cows' milk. The difficulty of precipitating the casein of human milk is said to be due to its opalisin. Mares' milk is in this respect, as in many others, intermediate between human milk and cows' milk.

The characteristics of opalisin are described.

On the yield and composition of sows' milk, W. A. HENRY and F. W. WOLL (*Wisconsin Sta. Rpt. 1897, pp. 10–19, fig. 1*).—Four farrowing sows were selected, 3 being pure-bred Poland Chinas and 1 a grade Chester White. Two of the sows were 2 years old and weighed nearly

450 lbs. each, while the other 2 were only 1 year old and weighed less than 300 lbs. each. The method of determining the yield was to weigh the pigs each time before and after suckling, keeping them confined between times in a pen near the dam. This weighing was continued on 3 days every 2 weeks until the pigs were weaned. In this way it was found that the average milk yield of the 4 sows ranged from 4.1 to 5.8 lbs. per day for the whole period of observation. The highest yield of milk in any one day was 8.7 lbs. and the lowest 1.2 lbs., the latter occurring just before weaning.

Some difficulty was had in securing samples of milk for analysis. "It was found that more milk could be obtained with less trouble by allowing a pig to empty an udder in part. At this stage the young animal was pushed aside, and the attendant quickly drew what milk he could from the teat before the dam became aware of what was happening." By this means small samples were obtained, seldom more than 1 fluid ounce. The analyses of 9 samples are tabulated. The average of these showed: Water 80.35 per cent, total solids 19.65, fat 8.24, and solids-not-fat 11.41. Excluding the first 2 analyses, which, owing to the smallness of the samples, were incomplete, the following averages are given for 7 samples:

Average composition of sows' milk, with variation.

	Average.	Lowest.	Highest.
	Per cent.	*Per cent.*	*Per cent.*
Water	80.96	79.5	82.9
Fat	7.06	3.9	9.5
Casein and albumin	6.20	5.3	7.3
Milk sugar	4.75	3.1	6.0
Ash	1.07	.8	1.3
Solids-not-fat	11.99	10.8	13.2

These results are compared with those given for sows' milk by other writers and with the averages for cows' milk. The results of 68 analyses reported by Dietrich and König, Petersen and Oetken, and the authors show the fat in sows' milk to range from 1 to 16.1 per cent, the average being 6.74 per cent. The wide variations in the composition of sows' milk are explained by the fact that the samples obtained represent fractional milkings.

"The average daily yield of milk of the 4 sows ranged from 4.1 to 5.8, or about 5 lbs. a day. If we consider this yield an average for good sows, and the fat content above given, 6.74 per cent, an approximately correct figure, we have that a sow will yield 0.337 lb. of fat a day, a very fair performance for an animal weighing only one-third as much as an average cow, especially since the milk-producing faculties of the sow have hardly received any thought from the breeder or the feeder.

"The microscopic examination of the milk shows that the fat globules of sows' milk are of a very minute size, on the average only about one-quarter that of average-sized fat globules in cows' milk. On the other hand, the number of globules in a given volume of milk is about 8 times as large in sows' milk as in cows' milk."

Comparative investigations of the applicability of different tests for ascertaining the fat content of milk, F. FRIIS (*Ber. K. Vet. Landbohojskoler Lab., Copenhagen, 1898, pp. 112*).—The tests compared in this report are Gerber's acid butyrometer, Fjord's control centrifuge (cream test), and the "lactoscope." Earlier experiments at this station have demonstrated the accuracy of the Gerber test. The lactoscope is an apparatus invented by a Danish engineer, P. V. P. Berg, for determining the quality of milk. It is a Fjord centrifugal cream test, modified so as to be used with an Alpha separator. The apparatus consists of a hollow steel cylinder fitting into the Alpha separator stand. Loose aluminum plates shaped to hold 24 test tubes are placed in this cylinder, which will hold 16 plates, or 384 test tubes at a time. The milk in the tubes is heated to 40° C. and rotated for 35 minutes at a speed of 6,000 revolutions per minute. The results agree with those obtained with the Fjord cream test, each "per cent cream" being equivalent to about 1.5 per cent fat. The author concludes that the lactoscope when operated according to directions may be used with perfect assurance of accuracy in separator creameries and private dairies.—F. W. WOLL.

Rancid butter, A. J. SWAVING (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1898, No. 11, pp. 759–762*).—The author reports two series of experiments with butter of unquestionable purity. In the first series, samples of melted and unmelted butter were kept in open and closed vessels, both in the dark and in the light, for 15 months, the volatile fatty acids being determined at the beginning and end of the experiment. There was a loss in volatile fatty acids in keeping the unmelted butter in both open and closed vessels, but a small increase in case of the melted butter.

The second series of experiments was like the first, except that the samples were kept for 5 years. The unmelted samples molded and assumed a dark color, while the melted samples remained a yellowish white and showed very little change in appearance. There was an increase in volatile fatty acids of the melted butter ranging from 1.7 to 2.3, the increase being greatest in the closed vessels. There was a loss of from 2.9 to 11.8 in case of the unmelted butter, the loss being materially greater in the open vessels, and in the dark.

The indications from these experiments are that in keeping unmelted butter there is a loss of volatile fatty acids, while in the case of melted butter the Reichert-Meissl number increases slightly. It is suggested that the difference in the behavior of melted and unmelted butter may be due to the presence of casein, milk sugar, and water in the unmelted butter. The greater loss of volatile fatty acids in darkness than in light is taken as a suggestion of the action of bacteria.

Experiments with a self-regulating pasteurizing apparatus, V. HENRIQUES and V. STRIBOLT (*Ber. K. Vet. Landbohojskoler Lab., Copenhagen, 1896, pp. 25; Tidsskr. Norske Landbr., 5 (1898), No. 10, pp. 527–533*).—The authors have adopted the principle of the Roux thermoregulator in constructing an apparatus which regulates the supply of milk to a

Fjord pasteurizer in such a manner that milk is admitted to the pasteurizer only when the temperature of the outgoing milk is above 85° C. If the temperature goes below 85° the difference in the expansion of the two parts of the regulator (a brass and a steel rod) closes a valve at the inlet and keeps it closed until the temperature of the milk at the outlet reaches 85°. The experiments made with the regulator in the laboratory and under factory conditions show that it will control the supply of milk so that the pasteurization temperature is practically constant at 85° C. The apparatus is described in detail in the report, and illustrations given of its various parts and connections.—F. W. WOLL.

Tolerance of certain milk bacteria toward ether, S. M. BABCOCK and H. L. RUSSELL (*Wisconsin Sta. Rpt. 1897, pp. 211–215*).—When fresh cheese curds were placed in an atmosphere saturated with ether vapor it was found that the oxygen disappeared entirely in a short time, being replaced by an equal volume of carbonic-acid gas. Microscopic examination showed that the whey expressed from these curds was teeming with bacteria. Cultures made from various colonies were placed in respiration chambers in atmospheres of ether, chloroform, and alcohol. There was evidence of growth except in the alcohol chamber.

Experiments to determine whether the organisms could live continuously were made with lactic-acid bacteria and with the organisms which have been found to grow in ether atmosphere. In these experiments the inspired air was drawn through ether, so that the air was saturated with ether vapor. The respiration of the lactic-acid cultures ceased within a short time after the admission of the ether, but that of the other culture continued for a period of 72 hours, the quantity of carbon dioxid evolved gradually decreasing during this period and finally ceasing.

"This experiment indicated that a saturated ether atmosphere was not especially suited for the development of the ether bacillus, but that it possessed a tolerance toward this anæsthetic that was far greater than any organisms heretofore reported."

The ether organism was cultivated for a period of 8 months on artificial media, during which it seemed to lose its ether-tolerating property. The culture characteristics of the organism are described. "In milk cultures it produces an abundance of lactic acid from the sugar in the milk, thus causing it to curdle quickly. No gas is produced in the milk at all."

Unorganized ferments of milk: A new factor in the ripening of cheese, S. M. BABCOCK and H. L. RUSSELL (*Wisconsin Sta. Rpt. 1897, pp. 161–193*).—The authors give a clear, concise account of the changes taking place in the ripening of cheese and the present status of the theories regarding the cause of these changes, followed by an account of their own investigations resulting in the discovery of an unorganized ferment as a natural component of milk.

"The enormous development of lactic-acid bacteria in hard cheeses and the elimination of the digesting or peptonizing organisms at an early stage of the ripening

has led Lloyd, working with English Cheddar, and Freudenreich, with the Swiss, both to ascribe to the milk-souring ferments the chief rôle in these changes.

"We have been able to confirm these results so far as the bacterial changes are concerned, but early in our work observations were made which did not conform to this theory.

"From two independent lines of research it became evident that profound changes of a physical and chemical nature occurred in milk in which bacterial fermentations had been excluded. In these experiments the casein of the milk underwent practically the same series of decomposition changes that are to be found in a ripening cheese, viz, the insoluble casein was converted into soluble proteids as indicated above.

"Parallel experiments with cheese gave the same result qualitatively and quantitatively; the products formed could not be distinguished from those of a normally cured cheese.

"Having eliminated the effect of the organized ferments (bacteria) by means of such chemical agents as ether, chloroform, benzol, etc., which do not affect the action of unorganized ferments, the conclusion was forced upon us that the changes which occurred were of a nonvital character and were undoubtedly due to enzyms. Two hypotheses as to the origin of these enzyms suggested themselves—either they were produced by bacteria which developed in the milk before the anæsthetics were applied, or they were inherent in the milk itself. The possibility of bacteria functioning in this way was excluded by securing milk drawn from the animal with great care and treated immediately with antiseptics. These freshly secured milks underwent identical changes with the others, showing that the enzyms were natural to the milk."

It was found that the proteids in separator slime digested more rapidly than those in skim milk, showing that the enzyms were separated in part in centrifugal creaming. Accordingly the slime was used for isolating the enzyms, the fresh slime being mixed with an equal weight of water containing 40 per cent of alcohol, the paste thus formed strained through cheese cloth, an antiseptic (either thymol or benzol) added to prevent fermentation, and the mass filtered after 24 hours. The filtrate was concentrated to about $\frac{1}{10}$ its volume (never heating over 25° C.). It was usually quite acid, and when neutralized with sodium carbonate gave a precipitate the filtrate from which was of a clear amber color, decomposed peroxid of hydrogen rapidly (a reaction common to most unorganized ferments), greatly hastened the formation of soluble products in milk, and liquefied gelatin.

"When added to milk it first coagulated the casein and afterwards redissolved the curd—the time required for this change depending upon the amount of extract added and the temperature. When the acid extract was added to milk the coagulation of the casein was hastened and the curd formed was firm and quite similar to that produced by rennet. In acid solution the digestion was much slower than in neutral or slightly alkalin solutions, indicating that the hydrolytic principle which it contains is more nearly related to a tryptic than to a peptic ferment. Attempts to obtain more concentrated extracts by precipitating the enzym from the above extract with absolute alcohol have thus far failed."

Various experiments are reported showing how the formation of soluble proteids in milk is accelerated by the enzym, that this power of digesting casein is destroyed by heat, and that the change does not occur as readily when even small amounts of hydrochloric acid are

present. "In this respect the character of the enzym present conforms closely to that of trypsin." Other experiments were made showing the power of the enzym extract to liquefy gelatin.

Tables are given showing the comparative rate of ripening in cheese and in milk. "The progressive nature of the changes in both cheese and milk are similar, the rate being somewhat more rapid in milk than in cheese, a fact of some moment when it is considered that bacterial activity was suspended in these milks."

The effect of temperature on ripening was also studied, cheese being kept at 55, 63, 73, and 86° F. The cheese kept at the higher temperatures ripened faster, which "is in conformity with what is well known concerning the action of enzyms under these conditions." A cheese more than a year old which has been kept under chloroform from the beginning, and, according to bacteriological examination, is perfectly sterile, is said to be thoroughly broken down, resembling a well-cured cheese. Chemical analysis shows that more than 50 per cent has been converted into soluble products. A sample of milk to which both ether and rennet were added after 4 months had 44.8 per cent of the total protein of the curd converted into soluble products. Both the cheese and the milk contained tyrosin and leucin like normal cured cheese. These same products were found in samples of skim milk kept under anæsthetic conditions for varying periods of time.

The authors discuss the relation of these inherent milk enzyms to current theories of cheese ripening and some other phenomena hitherto difficult to explain.

"It is our present belief that the ripening of hard cheese, instead of being due solely to bacteria, is caused by the joint action of both organized (bacteria) and unorganized ferments (enzyms). The breaking down of the casein is undoubtedly due, in larger part, to the action of enzyms. Concerning the production of the characteristic flavors, our knowledge is as yet too vague to warrant a definite assertion as to their origin. In all probability the bacteria in this relation play a much more important rôle."

Influence of temperature on the ripening of cheese, S. M. BABCOCK and H. L. RUSSELL (*Wisconsin Sta. Rpt. 1897, pp. 194–210, figs. 7*).—In the introduction the authors discuss the inadequate provision for curing cheese in the large majority of cheese factories, and call attention to the very deleterious effect of high temperatures on the quality of cheese. A diagram is given showing the actual temperature variation in an imperfectly constructed curing room in comparison with the variation in the cheese cellars of the Wisconsin dairy school. The zone which is stated to be invariably consistent with favorable results extends from 65° F. downward. In the investigations on the effect of temperature on the curing of cheese a special cheese-curing chamber was made in which the temperature could be controlled and varied at will by the use of ice or a gas burner, and another was made for lower temperatures (cold storage). The construction of these chambers is illustrated and described.

Five series of experiments were made, each series including from 3 to 5 full-sized cheeses made from mixed milk under identical conditions. These were cured at (1) a laboratory temperature, approximating 50° F.; (2) a normal curing-room temperature, ranging from 60 to 65°; and (3) an abnormally high temperature, 85°. Bacteriological and chemical examinations were made of the cheeses, the results of which are given:

"*Results of bacteriological analyses.*—(1) It was found that the bacterial flora of cheese cured at a low temperature (50 to 56° F.) retained for a certain period the same general aspect as that of the milk. In cheese cured under ordinary conditions there is almost immediately a differentiation as to the character of the micro-organisms present, the lactic-acid type acquiring the ascendency. In the refrigerated cheese this change is much less marked in the beginning, although it does occur in the course of time.

"(2) Bacterial growth in the cold cheese develops more slowly than at higher temperatures and persists for a longer period of time.

"(3) In cheese cured at a higher temperature the number of bacteria per gram is greatly diminished when compared with either a refrigerator or normal temperature cheese, and the bacteria fail to persist for as long a period of time.

"(4) Not only is there a quantitative differentiation between cheese cured in low and high temperatures, but a qualitative change is also more or less marked. In the beginning of the ripening process the flora is practically the same, but in the cheese cured at high temperatures there is a strong tendency toward differentiation when compared with the flora of a refrigerator cheese. It is possible that this differentiation in species may stand in close relation to the varying flavors of cheese cured under these divers conditions, and further experiments on this point are in progress.

"*Results of chemical analyses.*—(1) During the ordinary life of the cheese, the rate of curing changes is quite uniform, if the conditions are identical. When reduced to a curve it is apparent that it progresses somewhat more rapidly in the early stages than later.

"(2) The rate of the curing increases quite rapidly with a rise in temperature, and within the limits of our experiment has been nearly proportional to the temperature. Hence the cheeses cured at high temperatures were ready for consumption much earlier than those kept at low temperatures."

It was found in these investigations that cheese ripened faster (as measured by the formation of soluble proteids) at a high than at a low temperature, whereas the cheese cured at a high temperature contained less bacteria than that kept in cold storage. In other words, where the curing was most rapid there was a diminished bacteria content, a relation which is thought to be contradictory to the theory that the ripening of cheese is due exclusively to the action of micro-organisms, but in harmony with the theory of the action of enzyms, "as the enzyms naturally inherent in the milk would act much more rapidly at higher temperatures than they would at a lower degree."

The commercial value of the cold-storage cheese was rated by an expert at 7¾ cts., that cured at normal temperatures at about the same price, while that cured at a high temperature "had a rank flavor and a value not exceeding 3 or 4 cts. a pound." At that time prime Cheddar cheese was quoted at 7½ to 8 cts. The high temperatures impaired both the flavor and texture, whereas the cheeses cured at 55° and below were invariably of good quality and were entirely free from all bitter flavor.

The authors draw several practical deductions from the results of their work. "Here in Wisconsin the ordinary curing room almost invariably reaches a temperature in summer incompatible with proper curing," and as the expense of erecting suitable curing and storage rooms is considerable, central cooperative curing stations where the cheese from a number of factories could be shipped for ripening under safe and uniform conditions are suggested. The advantages of such a system are enumerated.

Further communications on the rôle of lactic-acid bacteria in the ripening of cheese, E. VON FREUDENREICH (*Milch Ztg., 27 (1898), No. 47, p. 738*).—The author refers to his previous work on this question (E. S. R., 10, p. 687), and reports the results of examination of a number of milk cultures of different lactic-acid bacteria more than a year old. These are presented as additional proof of his theory that the formation of soluble proteids during ripening is principally due to lactic-acid bacteria. Mention is made of Campbell's work with pure cultures[1] and a footnote reference is given to Babcock and Russell's discovery of enzyms in milk (p. 785).

On the question of the decomposition of milk fat in the ripening of cheese, H. WEIGMANN and A. BACKE (*Landw. Vers. Stat., 51 (1898), No. 1, pp. 1–14; and in Milch Ztg., 27 (1898), No. 48, pp. 757, 758; 49, pp. 774, 775*).—Previous investigations by Weigmann and Henzold showed that in the ripening of cheese the greater portion of the fat was unchanged. According to earlier work by Weigmann the fat in the ripening of Emmenthaler cheese is either not altered at all or only very slightly. Duclaux, on the other hand, has found that fat undergoes a change during ripening, this change being only slight at first, but very considerable after a long time; and while the change is at first limited to the glycerids of the volatile fatty acids, it is later extended to the glycerid of oleic acid.

The authors used in their investigations a number of different kinds of cheese of different age, employing the following method of analysis: The cheese was rubbed with sand, extracted with ether, and the dried ether extract purified by taking up in petroleum ether, and again dried at 100 to 105° C. The free fatty acids in the petroleum ether solution were obtained by neutralizing this extract, dissolved in ether and alcohol, with decinormal soda solution. Any unchanged fat was removed by shaking with petroleum ether. The alcohol was evaporated from the soap and the residue treated with dilute sulphuric acid, and the melted fatty acids removed from the surface, washed with water, and used for further investigation.

The authors' investigations are believed to show that a decomposition of the fat takes place in the ripening of cheese, though much the larger part of the fat remains unchanged. The cheeses used, where of ordinary ripeness, contained from 1 to 7 per cent of the fat in the form of higher nonvolatile fatty acids. Of the hard cheeses, the newest

[1] Jour. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 181–221; abstract will be given later.

(Edam, 2½ months old) contained the smallest amount of fatty acids, while a soft cheese, only ½ month older, contained nearly 7 per cent, indicating that the decomposition depends more on the intensity of the ripening of the cheese than on its age. The results also indicate that after a short time, even 2½ months, the decomposition may extend to the glycerids of the nonvolatile fatty acids.

Statistical data relating to the cheese industry in Wisconsin, J. W. DECKER (*Wisconsin Sta. Rpt. 1897, pp. 113-118*).—Statistics are given for 104 factories, the data showing the daily milk supply, average fat content, number of patrons, number of cows supplying the milk, method of paying for the milk, distance which the milk is hauled, etc. Some difficulty was found in getting reliable data as to the number of cows milked by each patron, but the data for 66 factories out of the 104 show a total of 15,571 cows, or an average of 239 cows to a factory.

"These cows gave 271,078 lbs. of milk per day; that is, an average of 17.2 lbs. per cow. There were 1,617 patrons in these 66 factories, making an average of 9.1 cows per patron. The factories vary greatly in the average amount of milk per cow, viz, from 10 to 30 lbs. per day. In 11 factories the average daily milk yield per cow is 10 to 15 lbs.; in 29 factories, 15 to 20 lbs.; in 19 factories, 20 to 25 lbs.; and in 8 factories, 25 to 30 lbs."

The other data are discussed at considerable length, and much interesting information is deduced as to the history of cheese factories, method of management, use of the Babcock test, payment of dividends, sale of cheese, character of buildings and equipment, curing rooms, disposition of the whey, prices of manufacture, etc.

Tables are given showing the temperatures recorded in different curing rooms, together with a description of the curing rooms at each of the 104 cheese factories. It was found that "the only curing rooms in the safe zone of temperature (see p. 787) were cellars and rooms ventilated by subearth ducts." Where properly constructed subearth ducts are used "the owners claim better cheese and less drying out." The method of building a duct is described. The system of central curing rooms for groups of factories is strongly recommended.

System of feeding milch cows at Ultana Agricultural Institute (Sweden) (*Nord. Mejeri Tidn., 13 (1898), No. 39, pp. 529, 530*).

Feeding experiments with molasses and sugar-beet residue, A. OLSCHBAUR (*Deut. Landw. Presse, 25 (1898), No 92, pp. 966, 967; 93, pp. 972, 973*).—A practical experiment with 4 cows in which a mixture of molasses and the dried residue from sugar-beet factories was compared with the latter without molasses, the rest of the ration being uniform. The 2 rations were about equal in value for the production of milk and fat, but the manurial value of the molasses ration was somewhat greater, owing to the potash contained in the molasses.

Eleventh annual report of the dairy school at Rütti, Switzerland, 1897-98 (*Elfter Jahresbericht der Molkereischule Rütti pro 1897-98. Bern: R. J. Wyss, 1898, pp. 54, pl. 1*).—Aside from the report of the school work the results of some analytical and experimental work are given. A monthly record is given of the fat content of the milk furnished to the creamery by 31 patrons during the year. This ranged from 2.6 to 3.76 and averaged 4.9 per cent. Analyses are also given of the milk and products at each stage during the manufacture of butter and cheese, and also of butter from sweet and from ripened cream and whey butter. A feeding experiment

is very briefly reported, in which the addition of 1 kg. of sesame cake and 1 kg. of cracked wheat per day to the basal ration had a favorable effect on the fat production, the fat content diminishing when this was dropped and increasing when it was restored in a subsequent period. In another experiment an increase in the amount of grain to 4 kg. is stated to have resulted in a decrease in the fat content of the milk.

The employment of artificial rennet preparations in cheese making, *E. von Freudenreich and R. Steinegger* (pp. 52-54).—Two experiments were made in the use of artificial rennet, against which there is said to be more or less prejudice in Switzerland. The conclusion is that artificial rennet, when properly prepared, is quite as well adapted to cheese making as natural rennet, and possesses some advantages, such as uniformity and convenience in using.

Composition of Swedish milk for infants, 1896–97 (*Nord. Mejeri Tidn., 13 (1898), No. 37, pp. 500, 501*).—Monthly averages for the contents of solids and fat and the specific gravity of certified milk for infant feeding supplied by the Stockholm Milk Commission. The average data for the whole year were as follows: 1896, specific gravity 1.0328, solids 12.03 per cent, and fat 4 per cent; 1897, specific gravity 1.032, solids 12.68 per cent, and fat 3.97 per cent. Average analyses of ordinary Stockholm whole milk are given by months, the mean fat content for the years 1896 and 1897 being 3.65 and 3.68 per cent, respectively.—F. W. WOLL.

State standards for dairy products, H. E. ALVORD (*U. S. Dept., Agr., Bureau of Animal Industry Circ. 25, p. 1*).—The standards for milk, skim milk, cream, butter, and cheese compiled from State dairy laws.

Report of milk-control stations of Norway, 1897 (*Aarsber. Offent. Foranst. Fremme, 1897, pp. 205–210*).—Three of the stations were in operation during 1897, viz. in Christiania, Bergen, and Trondhjem. The total number of samples of whole milk tested for fat content was: Chistiania 32,259, Bergen 15,195, and Trondhjem 30,927 samples. The fluctuation in the monthly averages (which are in each case made up of a fairly uniform number of samples) and the annual averages for the 3 stations are shown below:

Average percentage of fat found in whole milk, 1897.

Month.	Milk-control station at—			Month.	Milk-control station at—		
	Christiania.	Bergen.	Trondhjem.		Christiania.	Bergen.	Trondhjem.
January	3.39	....	3.35	August	3.46	3.90	3.49
February	3.42	3.30	3.28	September	3.59	4.03	3.55
March	3.35	3.36	3.21	October	3.75	4.36	3.53
April	3.32	3.26	3.12	November	3.61	3.52	3.60
May	3.32	3.34	3.22	December	3.46	3.33	3.53
June	3.41	3.46	3.59				
July	3.49	3.82	3.50	Average for year	3.467	3.573	3.414

—F. W. WOLL.

Methods of adulteration of butter and cheese, J. LANDIN (*Nord. Mejeri Tidn., 13 (1898), No. 39, p. 527*).

Dairy legislation, J. W. ROBERTSON (*Rpt. Comr. Agr. and Dairying Canada, 1897, pt. 10, pp. 5–16*).—Enactments affecting the dairy interests in Canada are quoted and discussed in a popular manner.

The milk supply of Padua (Italy), E. CAPPELLETTI (*Sul. latta die Padora. Richerche chemico-Batteriologiche. Institute of Hygiene of the Univ. of Padua, 1897, pp. 40*).—A chemical and bacteriological study.

Centrifugal milk analysis, F. W. WOLL (*Jour. Appl. Micros., 1 (1898), No. 12, pp. 209–211, fig. 1*).—An adaptation of a urinary centrifuge to the testing of milk by the Babcock method. Although only about one-ninth as much milk is taken as in the regular Babcock test, there is said to be no difficulty in obtaining accurate results after a little practice.

Dairy bacteriology, W. T. CONNELL (*Rpt. Comr. Agr. and Dairying Canada, 1897, pt. 16, pp. 4–16, figs. 13*).—This treats in a popular manner of the characteristics of bacteria, fermentations of milk, pasteurization, means of infection, fermentation in cheese making, etc.

Sterilizing milk: Improved method of and apparatus for, N. BENDIXEN (*English Pat. No. 12869; Jour. Soc. Chem. Ind., 17 (1898), No. 11, p. 1067*).—The method employed is to saturate the milk with carbon dioxid, boil for about half an hour under pressure at a temperature of about 120° C., and then to pass a current of pure sterile air through it. The milk is said to retain its taste and other properties. The apparatus used is described in the abstract.

Pasteurization and pure culture in Swedish creameries, N. ENGSTRÖM (*Tidskr. Landtman, 19 (1898), No. 38, pp. 675–680; Nord. Mejeri Tidn., 13 (1898), No. 40, pp. 543–545*).—During 1897, 317 creameries or private dairies participated in the Swedish butter exhibitions. Of these, 66.9 per cent pasteurized their cream all the time, 16.4 per cent did so at times, and 16.4 per cent not at all; 19.9 per cent used pure-culture starters regularly, 16.4 per cent at times, and 57.4 per cent not at all; 3.5 per cent churned sweet cream, and 2.5 per cent were radiator creameries. The proportion of creameries which pasteurize their cream and use pure cultures has steadily increased of late years.

Of the pasteurized butter exhibited, 51.7 per cent, on the average, was scored in class 1 (fine), 35.4 per cent in class 2 (good), and 12.9 per cent in class 3 (fair). Of the unpasteurized butter 16.3 per cent was scored as fine, 42.9 per cent as good, and 40.8 per cent as fair.—F. W. WOLL.

On the making of butter, J. W. ROBERTSON (*Rpt. Comr. Agr. and Dairying Canada, 1897, pt. 4, pp. 17–23*).—Popular notes on the separating, ripening, and churning of cream, and the working, packing, and handling of butter.

The development and present status of cooperative creameries in the Grand Duchy of Mecklenburg-Schwerin, J. SIEDEL (*Milch Ztg., 27 (1898), No. 48, pp. 753–755; 49, pp. 770–772; 50, pp. 788, 789; 52, pp. 819–821*).

Statistics from fifty-two Wisconsin separator creameries, E. H. FARRINGTON (*Wisconsin Sta. Rpt. 1897, pp. 82–112*).—A reprint, somewhat abridged, of Bulletin 56 of the station (E. S. R., 9, p. 286).

The distribution of cheese and butter factories in Wisconsin, S. M. BABCOCK, H. L. RUSSELL, and J. W. DECKER (*Wisconsin Sta. Rpt. 1897, pp. 149–152, pl. 1*).—According to this article there were in Wisconsin, in 1897, 951 creameries and 1,571 cheese factories. An account is given of the development and growth of the dairy industry in the State and the present distribution of butter and cheese factories, and a plate showing their location.

"Since 1890 the cheese industry has remained practically at a standstill, although the butter production has largely increased. The reason for this is the relatively higher price for butter during this period, a condition that was caused to a considerable extent by the manufacture of fraudulent cheese products (skimmed and filled cheese)."

Preparation of cheeses from sheep's milk (*Poltava, 1897, pp. 12; rev. in Selsk. Khoz. i Lyesor., 188 (1898), No. 2, p. 474*).—This includes a description of the making of "Pekarino" cheese by E. E. Rostovtsev and of "Crinza" and "Kachkaval" cheeses by S. G. Leontovich.

The biology of cheese ripening, S. M. BABCOCK and H. L. RUSSELL (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 420, 421*).—The authors report the discovery in milk of an unorganized ferment, "galactase" (E. S. R., 9, p. 205), and discuss the importance of its bearing on the ripening of cheese.

The occurrence of relatively large colonies of bacteria in inferior Emmenthaler cheese, R. BURRI (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 15–16, pp. 608–615*).—A cheese was examined which contained numerous dark-colored spots, occurring all through the cheese. Investigation showed the spots to be due to large colonies of bacteria, and that all the colonies were of one and the same species of bacteria.

The micro-organism was isolated and studied. It is suggested that possibly the conditions at the points where the spots occurred were so especially favorable for the bacteria that they were able to withstand the competition of other bacteria and formed relatively large colonies, visible to the naked eye.

On the formation of holes in cheese, F. BAGGE (*Nord. Mejeri Tidn., 13 (1898), No. 35, pp. 475–477*).

VETERINARY SCIENCE AND PRACTICE.

Proceedings of the second annual meeting of the Association of Experiment Station Veterinarians (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 22, pp. 29*).—In addition to the usual statistical information the report contains the papers presented at the meeting of the Association at Omaha, September, 1898. These were: Growing tubercle bacilli for tuberculin, C. A. Cary; The experiment station veterinarian as a member of the State Board of Health; Laboratory records for veterinarians, A. W. Bitting; The desirability of cooperation between the station veterinarian and local veterinarians in the State, A. W. Bitting; The exhibit of the United States Experiment Station veterinarians at the Paris Exposition in 1900, A. T. Peters; The value to veterinarians of cooperative experiments, L. L. Lewis; Constitution and by-laws of the Association of Experiment Station Veterinarians, and Feeding wild plants to sheep, S. B. Nelson.

The last article reports the feeding of a number of plants, several of which are regarded as poisonous, to sheep. These were: *Delphinium menziesii*, *Castilleja pallescens*, *Crepis barbigera*, *Astragalus dorycnioides*, *A. spaldingii*, *A. palousensis*, *Zygadenus venenosus*, *Frasera albicaulis*, *Antenaria luzuloides*, *Sisyrinchium grandiflorum*, and *Arnica fulgens*.

The following plants, which are not regarded as poisonous, were also fed: *Saxifraga integufolia*, *Lupinus ornatus*, *Leptotænia multifida*, *Peucedanum grayii*, *Synthyris rubra*, *Clematis douglasii*, *Heuchera glabella*, *Lithospermum pilosum*, Geranium, Potentilla, *Eriogonum heracleoides*, *Geum triflorum*, *Grindelia nana*, and *Chænactis douglasii*.

Negative results were obtained in all cases.

Sheep scab: Its nature and treatment, D. E. SALMON and C. W. STILES (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 21, pp. 61, pls. 6, figs. 35*).—This is an extended discussion of the subject. In addition to historical matter, the principal points treated of are the cause of the scab, description of the scab of different sorts and treatment, and the conditions which may be mistaken for scab. Dipping is regarded as the most effective treatment for scab, and detailed descriptions are given of different methods of conducting this operation. Federal laws and regulations relative to sheep scab are quoted.

On bovine tuberculosis and its eradication, O. MALM (*Tidsskr. Norske Landbr., 5 (1898), No. 10, pp. 475–525*).—This is a general discussion of the subject, with special reference to conditions in Norway. From 1895 to 1897, inclusive, 55,542 animals have been tested with tuberculin under the author's direction. Of these, 36 per cent were found to be affected with tuberculosis. The animals examined

were distributed in 1,331 herds, 26.55 per cent of this number containing tuberculous animals. According to an earlier investigation[1] of the author's, different breeds of cattle have shown the following percentages of tuberculous individuals: Common Norwegian natives, 6.7 per cent; Telemark, 4.9 per cent; Ayrshire, 15.1 per cent; mixed breeds, 12.4 per cent; various or unknown breeds, 3.8 per cent. According to the age of the animals, reaction to the tuberculin test was as follows: Under 6 months, 1.9 per cent; 6 months to 1 year, 3.2 per cent; 1 to 5 years, 7.1 per cent; over 5 years, 10.4 per cent; age not known, 7.5 per cent.—F. W. WOLL.

Milk from tuberculous cows, C. H. HARRISON (*Ontario Agr. Col. Rpt. 1897, pp. 147–149*).—Experimental tests showed that milk may be tuberculous though the udder is not affected. In one case a cow gave no reaction, but was found upon *post-mortem* examination to be generally affected with tuberculosis. One of the cows gave a reaction, but the milk was not affected.

On the chemistry of tubercle bacilli, W. G. RUPPEL (*Ztschr. Physiol. Chem., 26 (1898), No. 3–4, pp. 218–232*).

Tuberculin, C. H. HARRISON (*Ontario Agr. Col. Rpt. 1897, pp. 144–147, figs. 4*).—Popular directions for applying the tuberculin test are given, together with a summary of tests made with the herd at the college farm. One hundred and sixty, or 24 per cent of the 762 animals tested, were diseased.

Report of superintendent of the civil veterinary department, F. RAYMOND (*Ann. Rpt. Civ. Vet. Dept. [Bengal], 1897–98, pp. 20*).—In addition to statistical and other information concerning the Bengal Veterinary Institution, the article contains an account of rinderpest experiments and information concerning contagious diseases in various districts of India.

Blackleg, E. P. NILES (*Virginia Sta. Bul. 75, pp. 37–42*).—This is a general article describing the causes, symptoms, and treatment of blackleg. The fact is emphasized that the only hope of exterminating this disease lies in combative treatment by vaccination.

The cattle tick in Virginia, E. P. NILES (*Virginia Sta. Bul. 76, pp. 45–56*).—The author describes the different cattle ticks. The regions in Virginia already infested with them are mentioned and the desirability of quarantine is pointed out. The various methods of preventing ticks are described and measures discussed for exterminating them in Virginia and preventing their importation.

Modern views as to milk fever and its treatment, A. BERGSTRAND (*Landmansblade, 31 (1898), No. 10, pp. 145–148*).

Concerning the bacteria in the air passages, T. BARTHEL (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 11, pp. 401–414; 12, pp. 433–441*).—The bacteria of the trachea, bronchial tubes, etc., were examined.

An active principle in millet hay, E. F. LADD (*Amer. Chem. Jour., 20 (1898), No. 10, pp. 862–866*).—The author reports the isolation of a glucosid from the aqueous extract of millet hay, which on small animals produced the characteristic symptoms of millet disease.

Poisoning of cattle by the saltpeter on the walls of stables, L. GRANDEAU (*Jour. Agr. Prat., 1898, II, No. 50, pp. 846, 847*).

Poisoning of swine by too heavy molasses feeding, L. BRANIE (*Tidskr. Landtmän, 19 (1898), No. 42, pp. 758–760*).—Three fattening pigs, 7 to 9 months old, fed for 3 weeks on molasses feed (1 part bran, 1 part palm-nut meal, and 2 parts molasses), were taken suddenly sick, and were killed in a dying condition. The presence of potash salts in the molasses is ascribed as the cause.

Cribbing and its operative treatment, S. J. J. HARGER (*Jour. Comp. Med., 20 (1899), No. 1, pp. 22–25*).—A number of cases are briefly reported.

A new method of employing charcoal in the treatment of acute indigestion in horses, G. J. GOUBEAUD (*Jour. Comp. Med., 20 (1899), No. 1, pp. 16–22*).—A paper read before the Veterinary Medical Association of New York County, New York.

[1] Report Veterinary Department for 1896, Norges Offic. Statistik., 3. ser., No. 299.

The author recommends that charcoal should be heated before administration to drive off the absorbed gases.

The disappearance of pathogenic organisms from manure and compost, A. GÄRTNER (*Ztschr. Hyg. u. Infektionskrank.*, *28* (*1898*), *No. 1, pp. 1–19*).

Notes on an experimental study of the disinfecting power of common soap, J. ALEXANDROW (*Russk. Arch. Patol. Klin. Med. i Bakt.*, *4* (*1897*), *No. 6, pp. 676–685*).

Experimental studies on the disinfecting power of ordinary soaps, A. SERAFINI (*Arch. Hyg.*, *33* (*1898*), *No. 4, pp. 369–399*).—A number of experiments are reported.

The investigation of Dr. Koch on animal diseases in Africa, E. L. (*Rev. Gén. Agron.*, *7* (*1898*), *No. 11, pp. 485–491*).—A brief summary.

The literature of veterinary medicine and allied sciences, R. SCHÖTZ (*Die Litteratur der Veterinärwissenschaft und verwandter Gebiete. Berlin, 1898; rev. in Ztschr. Fleisch u. Milchhyg.*, *9* (*1898*), *No. 2, p. 37*).—The period covered is from April 1, 1889, to July 1, 1898.

AGRICULTURAL ENGINEERING.

Loss from canals from filtration or seepage, L. G. CARPENTER (*Colorado Sta. Bul. 48, pp. 36, fig. 1*).—A series of observations were made on "stretches of canals in the Platte Valley and Cache la Poudre Valley near Fort Collins and several in the San Luis Valley, and one canal on which automatic records were kept for 2 years. The method of measurement was essentially the same in all cases, namely, to measure the amount flowing in the canal at different points, and then to compare the increase or decrease in the amount of water in the canal after allowing for the water taken out by laterals between the points of measurement."

The results are discussed in detail and summarized as follows:

"(1) The losses from evaporation are relatively insignificant compared with the seepage losses from most canals. In the cases most favorable to evaporation and least favorable to seepage the evaporation is not over 15 per cent of the seepage.

"(2) In the case of reservoirs it was concluded in bulletin 45 that the seepage was less important than the evaporation. This is different from the results found in ditches, not because the evaporation is less, but because the seepage is much more.

"(3) The losses are sometimes enough to cover the whole canal 20 ft. deep per day.

"(4) The loss in clay soils is less than in sandy or gravelly soils, but rarely as small as 3 in. daily.

"(5) The loss is greater when water is first turned in than after the bed has become saturated.

"(6) Sometimes the canals are found to gain for the whole or part of their length or the canals may act as drains. This is more likely to be the case when the canal is deep in the ground, when crossing lines of drainage, or when located below other ditches or irrigated tracts.

"(7) In the prevailing Colorado soil, when not intercepting seepage, the loss may be put provisionally at from 1 to 2 ft. per day over the whole surface of the canal. In clay soils it is less, but still nearly one-half as much.

"(8) The loss in carrying water in small quantities is relatively larger than in carrying large amounts. The increased depth of water means increased leakage, but the carrying capacity increases faster than the leakage.

"(8*a*) From the standpoint of economy it is wasteful to run a small head. It is more economical to run a large head for a short time. In the management of small ditches the time system of distribution can be introduced to advantage, saving time and labor as well as water.

"(9) It is wasteful to use 2 ditches or laterals when 1 would serve.

"(10) The loss increases with higher temperature, being about twice as much at 80° as at 32°.

"(11) The loss increases with greater depth of water, but the exact relation needs further investigation.

"(12) The loss will be lessened by any process which forms or tends to form an impervious lining or coating of fine material, as of clay or silt. The silt, consisting of fine sand, improves many soils. Clay is better and especially limey clay, the lime with the clay forming an almost impervious coating.

"(13) Cement linings as used in California and Mexico are not warranted by the conditions in Colorado, nor would the weather conditions be favorable. Nor is the use of wooden stave piping for this purpose likely to be profitable in many places in the State, if at all on the larger canals at present. The silting process applied with discrimination will accomplish much at smaller cost.

"(14) On small laterals glazed sewer pipes may save annoyance often connected with the carrying of water in laterals for considerable distances, which, with the saving of water, may make its use an object. One of the supply laterals of the Colorado Agricultural College is of vitrified sewer pipe, over 4,000 ft. of 12-inch pipe being used.

"(15) Some particular sections in canals are subject to much greater loss than the canal as a whole. Hence water can be saved by locating the leaky place and remedying it. This may be desirable to do while it would be unprofitable to treat the whole canal.

"(16) There are many places where it would be advantageous to combine 2 ditches, by this means saving not only the loss of water, but saving superintendence and maintenance charges. With increased confidence in the accuracy of water measurement, reluctance to such consolidations should lessen.

"(17) The depth of losses from laterals is probably greater than in the main ditches. The laterals are less permanent, are steeper, have less silt, and are more poorly cared for.

"(18) There must be some arrangement of ditches and laterals which is the most economical for given conditions, so that the aggregate of the losses of the whole system will be a minimum. Certainly the location and arrangement of the laterals for carrying water from the main ditch is worthy of consideration by the management of the main canal, and the importance increases with the size of the canal and the width of the strip it serves.

"(19) It is not to be understood that the whole of the loss from the ditches is lost to the public wealth of the State. Some, perhaps much, of the loss, may reappear as seepage in lower ditches or in the main stream and again be used. It is, however, lost to the particular ditch, and incidentally is destructive to much land. With all practicable methods of prevention there will still be abundant loss. It should be to the advantage of the individual ditch to prevent such loss as far as practicable.

"(20) A general statement of the total amount of loss of water must be made and accepted with reservation. It would appear that in the main canals from 15 to 40 per cent is lost, and in the laterals as much more. It would thus appear that not much over one-half, certainly not over two-thirds, of the water taken from the stream reaches the fields. In the most favorable aspect the loss is great, and is relatively greatest when the loss can be least afforded, viz, when the water is low and the ditches are running with reduced heads.

"(21) There are some 2,000,000 acres of land irrigated in Colorado, and the value of the water rights at a low estimate is as much as \$30,000,000. (The census estimates the water rights as worth \$28.46 per acre.) On this basis the capital value of the water lost by seepage in the canals and ditches may be put at from \$6,000,000 to \$10,000,000. From the evidence at hand at present this seems a low estimate."

Report of trials with insulating materials, E. J. Bonnesen (*Tidsskr. Landökon., 17 (1898), No. 5–6, pp. 379–394*).—The materials tested were placed between zinc cylinders 19 in. in diameter and 3½ ft.

high, and galvanized-iron cylinders 25 in. in diameter and 4 ft. high (placed one within the other). Ice was kept in the zinc cylinders, and the water melted from the ice weighed twice a day, the room temperature being kept constant throughout the trial, which lasted about 3 weeks. The following table gives a summary of the observations taken:

Trials with insulating materials, 1898.

	Weight of melted ice in 24 hours.	Weight of insulating material.	Comparative insulating power.	
			Thickness.	Weight.
	Pounds.	*Pounds.*		
Cork refuse	5.97	47.0	78.2	61.8
"Cork stone," crushed	6.84	81.5	89.6	122.7
Straw band	7.40	48.0	97.0	78.3
Heather packed	7.40	72.5	97.0	118.2
Cut straw	7.63	59.5	100.0	100.0
Paper	7.82	49.5	102.5	85.3
Heather, loose	7.84	38.0	102.8	65.7
Rice hulls	8.19	85.0	107.3	153.3
Siliceous earth ("kiselgur")	11.79	201.0	154.5	521.9

—F. W. WOLL.

A simple and efficient method of irrigating the soil, C. SCHULER (*Landw. Jahrb. Schweiz, 11 (1897), pp. 369-377, pls. 2, chart 1*).—The distribution of rainfall (with chart of normals) and the need of irrigation in Switzerland are discussed, the conclusion being reached that only simple, cheap methods of irrigation can be profitably employed. A method of irrigation in which the soil is flooded by means of gates at intervals in the ditch is described.

Manure platforms, M. RINGELMANN (*Jour. Agr. Prat., 1898, II, No. 51, pp. 892-897, figs. 7*).—Plans and descriptions are given,

Manure yards, M. RINGELMANN (*Jour. Agr. Prat., 1898, II, No. 52, pp. 923-926, figs. 4*).—Plans and descriptions of covered and uncovered yards.

Pit or platform for manure, H. D'ANCHALD (*Jour. Agr. Prat., 1899, I, No. 3, pp. 93, 94*).—A brief note on the relative merits of these two means of storing manure.

The amount of water pumped by a geared 16-foot aermotor windmill, F. H. KING (*Wisconsin Sta. Rpt. 1897, pp. 240-248, figs. 3*).—This is a preliminary account of experiments more fully reported in Bulletin No. 68 of the station (E. S. R., 10, p. 695).

The Venturi meter (*Jour. Franklin Inst., 147 (1899), No. 2, pp. 108-145, figs. 33*).—Report of the Committee on Science and the Arts of the Franklin Institute on the inventions of Clemens Herschel, Frederick N. Connet, and Walter W. Jackson. The Elliott-Cresson Gold Medal (the highest honor in the gift of the institute) was awarded to the first mentioned for the invention of the Venturi tube, and the John Scott Legacy Premium to the other two for their registering apparatus adapted to use with the Venturi meter.

Lightning rods and protection of farm buildings from lightning, R. C. KEDZIE (*Michigan Sta. Spec. Bul. 3, pp. 8*).—A popular article.

STATISTICS—MISCELLANEOUS.

Report of Idaho Station for 1898 (*Idaho Sta. Bul. 15, pp. 139-180*).—This contains reports of the director and the heads of departments, parts of which are noted elsewhere, on the station work for the year, and financial statements for the fiscal years ending June 30, 1897 and 1898.

Annual Report of South Dakota Station, 1898 (*South Dakota Sta. Rpt. 1898, pp. 7-19*).—This contains a report of the director, including a financial statement for the

year ending June 30, 1898, and brief reports of the agriculturist, horticulturist, chemist, and botanist and entomologist.

Sixth Annual Report of Washington Station, 1896 (*Washington Sta. Rpt. 1896, pp. 56*).—This includes reports by the director, botanist and entomologist, veterinarian, horticulturist, and chemist; a meteorological report, and a financial report for the fiscal year ending June 30, 1896. Some of these are noted elsewhere.

Fourteenth Annual Report of Wisconsin Station, 1897 (*Wisconsin Sta. Rpt. 1897, pp. 338*).—This contains the report of the director on the station staff, work, and publications; various articles noted elsewhere; lists of exchanges and acknowledgments; and a financial statement for the fiscal year ending June 30, 1897.

Report of the agricultural department, Finland, for 1896, N. GROTENFELT (*Landbr. Styr. Meddel., 1897, No. 22, pp. 207*).

Report of the agricultural department, Norway, for 1897 (*Aarsber. Offent. Foranst. Fremme, 1898, pp. 478*).

Report of the agricultural experiment station of Poltava for 1896, V. N. DIAKOV (*Poltava, 1897, pp. IV + 207: rev. in Selsk. Khoz. i Lyesov., 188 (1898), No. 2, pp. 470, 471*).

Constitution of the Association of Agricultural Experiment Stations in the German Empire (*Landw. Vers. Stat., 51 (1898), No. 1, pp. 83–86*).—Text of the constitution as it now stands.

NOTES.

Alabama Canebrake Station.—W. M. Booker, a member of the governing board, has recently died. The vacancy in the board has not yet been filled. The Thirteenth Annual Report of the station has just been issued.

Iowa Station.—Arrangements have been made for a series of experiments in roadmaking at the station during the coming season, in cooperation with the Office of Road Inquiry of this Department.

Kansas College and Station.—A. J. Burkholder, M. D., D. V. S., has been appointed assistant in veterinary science and biology in the college and station. The number of farmers' institutes held this year has been greater than ever before, being 62. This result has been attained by grouping institutes so that several could be attended at one trip, thus saving both time and expense. Three sets of bulletins are sent out: The ordinary pamphlet bulletins, weekly press bulletins to the county newspapers, and another set of occasional press bulletins in mimeograph typewriting to the agricultural papers which circulate in Kansas. During February and March an extra number of some of the press bulletins is printed and mailed to the pamphlet bulletin list; at the same time an unusual number of different press bulletins is issued, the object being to place before the farmers information which they need at this season. The State legislature has appropriated $25,000 for a dairy building, $6,000 for equipment, and $3,000 for a herd and stable.

Michigan College and Station.—The following changes have been made in the governing board of the station: E. P. Allen, of Ypsilanti; H. F. Marsh, of Allegan, and L. Whitney Watkins, of Manchester, have been appointed, *vice* Arthur C. Bird, Charles W. Garfield, and Charles F. Moore, retired. T. F. Marston, of Bay City, has been elected president of the board, *vice* Franklin Wells, who still continues on the board. Arthur C. Bird has succeeded Ira H. Butterfield as secretary of the State board of agriculture and secretary and treasurer of the station. The work of the farm department has been subdivided, the field crops and plat work being placed in charge of J. D. Towar, the live stock under H. W. Mumford, and the dairy work under G. H. True. During the season of 1899 the work with sugar beets will be continued, sending out seed furnished by the Government for definite experiments as to fertilizers and methods of cultivation. At the station the plat work with sugar beets will relate to kinds and methods of application of fertilizers and means of avoiding as far as possible the work of thinning. Experiments are being concluded on the feeding of beet pulp to dairy cows.

North Carolina College and Station.—The new members of the board of trustees, elected by the General Assembly March 6, are as follows: Frank Wood, of Edenton; J. B. Stokes, of Windsor; W. J. Peele, of Raleigh; D. A. Tompkins, of Charlotte; E. Y. Webb, of Shelby; W. C. Fields, of Sparta; J. Frank Ray, of Franklin; W. H. Ragan, of High Point; David Clark, of Charlotte; T. B. Twitty, of Rutherfordton; A. Leazar, of Mooresville; H. E. Bonitz, of Wilmington; R. L. Smith, of Albemarle; H. E. Fries, of Salem; and P. J. Sinclair, of Marion. W. S. Primrose, of Raleigh, has been elected president of the board, *vice* J. C. L. Harris, resigned. Mr. Harris is still a member of the board. The terms of office of the following have expired: J. J. Britt, J. R. Chamberlain, S. L. Crowder, and W. C. O'Berry. Cooper Curtice, veterinarian, has been granted leave of absence for the

remainder of the fiscal year, to enter the service of the State Department of Agriculture. In accordance with the act of the General Assembly of 1899, on July 1 next the analytical work of the fertilizer control will be performed by the chemist of the State Department of Agriculture and not in connection with the station. On July 1, therefore, the fertilizer control division of the station will be discontinued.

OKLAHOMA COLLEGE AND STATION.—The following appointments have been made on the board of regents: Jas. P. Gandy, of Alva, *vice* B. S. Barnes, late president of the board, and J. D. Ballard, of Weatherford, *vice* R. J. Edwards. F. J. Wykoff, of Stillwater, has been elected president, and C. J. Benson, of Shawnee, has been reelected treasurer of the board. The State legislature has made appropriations approximating $30,000 for buildings and equipment and about $8,000 for maintenance of the college for the next two years. It is expected that these sums will be appropriated in such ways as to considerably increase the facilities for work by the station staff.

TEXAS COLLEGE AND STATION.—A bill has recently passed the State legislature providing for a State entomologist to study the cotton bollworm and other insect pests of the State and to give instruction in entomology at the college. An appropriation of $5,000 is made for salaries and other expenses.

VERMONT STATION.—W. C. Norcross has been succeeded by G. W. Strong as dairyman.

WEST VIRGINIA UNIVERSITY AND STATION.—The Mechanical Hall of the university was destroyed by fire March 4, together with the valuable equipment which it contained. The building and contents were valued at $40,000. The insurance carried on the building was $28,000. The net loss will not exceed $4,600. Arrangements for rebuilding are being made. The State legislature has appropriated $5,500 for the station, to defray the expense of printing bulletins and reports, purchasing stationery, and office supplies, etc.

WYOMING UNIVERSITY AND STATION.—The station farm has been increased by the addition of 80 acres of land under the Pioneer Canal, along with the water right for the same. This land is to be held as the property of the university so long as it is used for experimental purposes. The land is virgin soil, having never been fenced or plowed. It joins the present farm on the south and will be used mainly for some extensive field experiments in irrigation.

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS.—F. S. Shiver, Clemson College, South Carolina, is the referee for nitrogen for the coming year, instead of B. L. Hartwell as stated in a former issue (E. S. R., 10, p. 512).

NECROLOGY.—Dr. Albert Schultz died at Lupitz, Germany, January 5, 1899, at the age of 68 years. He was one of the most prominent agriculturists of Germany, and widely known as the originator of the Schultz-Lupitz system of culture, by which poor, sandy soils are brought to a state of fertility through the combined use of leguminous crops in the rotation and phosphates and potash salts as fertilizers. Schultz-Lupitz was a charter member of the Deutsche Landwirtschaftliche Gesellschaft, and a prolific writer on agricultural subjects. For several years he was a member of the German Reichstag. The utility of his system of culture, especially the importance of legumes in the rotation for the assimilation of the free nitrogen of the air, was demonstrated under his management on his own lands. His estate was formerly known as the Desert of Lupitz, the soil being a coarse-grained, diluvial sand, destitute of lime and extremely poor in potash, nitrogen, and phosphoric acid. Through his method of culture the estate was brought to its present high state of fertility.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director*.

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers, and Soils (including methods of analysis), and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
——— ———Entomology and Veterinary Science.
——— ———Horticulture.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 9.

The act of Congress making appropriation for this Department for another year includes several new features which, together with increased funds for many of the bureaus and divisions, will materially strengthen the Department and extend its sphere of usefulness. It provides an increase of nearly $200,000 over last year and of more than half a million dollars over the year previous, the total appropriation for the closing fiscal year of the century being $3,726,022. This includes the $720,000 for the agricultural experiment stations in forty-eight States and Territories, and a special appropriation for the establishment and maintenance of experiment stations in Alaska.

The largest increases in appropriation are for the Weather Bureau and the Bureau of Animal Industry. The total appropriation for the Weather Bureau is $1,022,482, which includes an increase of $60,000 for the maintenance of the new stations in the West Indies and adjacent coast, and $25,000 for the erection of an addition to the present buildings of the Bureau in Washington.

The total appropriation for the Bureau of Animal Industry is $1,044,030. This includes $50,000 additional for investigations and inspection and $20,000 "for the purchase and equipment of land in the vicinity of Washington for an experiment station for the study of the diseases affecting the domesticated animals." The Secretary of Agriculture is also authorized to expend a sum within his discretion "for promoting the extension and development of foreign markets for dairy and other farm products of the United States."

The fund for irrigation investigations has been increased to $35,000, $10,000 of which is made immediately available. The object stated is "to investigate and report upon the laws and institutions relating to irrigation and upon the use of irrigation waters, with special suggestions of better methods for the utilization of irrigation waters in agriculture;" and it is directed that this investigation shall be carried on in cooperation with the experiment stations, "in such manner and to such extent as may be warranted by a due regard to the varying conditions and needs of the respective States and Territories and as may be mutually agreed upon."

The scope of the Division of Forestry is enlarged to include the subjects of forest fires, lumbering, the advising of owners of woodlands as

to their proper care, and forestry experiments for the treeless region. An increase of $20,000 is provided, making a total of $48,520 for this division.

An appropriation of $10,000 is made for tobacco investigations, including the mapping of tobacco soils; study of soils and conditions of growth in Cuba, Sumatra, and other competing countries; investigations on the methods of curing, with particular reference to fermentation; and originating improved varieties by means of selection and breeding. These investigations will be in charge of the Division of Soils.

The Division of Chemistry receives $34,000—an increase of $5,300—$2,500 of which is for the equipment of the new laboratory and is made immediately available. A new clause relative to investigation on the adulteration of foods, drugs, and liquors authorizes the Secretary of Agriculture to procure through the Secretary of the Treasury samples of articles imported from foreign countries which are suspected of being dangerous to health; and such articles as are found by inspection and analysis to be dangerous to health are to be confiscated.

An appropriation of $1,000 is made for tea culture, to investigate its adaptability to the Southern States.

The appropriation for the Division of Publications contains an increase of $15,000, giving a total of $101,660, including $35,000 for Farmers' Bulletins. This is apart from the printing fund of the Department, which is provided in the general appropriation for printing. The Department's share of the latter is $100,000 for the miscellaneous publications, and to this is added $300,000 for the Yearbook.

The other items of the appropriation act are as follows: Office of the Secretary, $88,150; Division of Statistics, $145,160, an increase of $5,000; Division of Botany, $28,800; Division of Vegetable Physiology and Pathology, $32,500, an increase of $6,000; Division of Entomology, $30,700; Division of Biological Survey, $27,560; Division of Soils, $26,300, including the $10,000 for tobacco investigations; Division of Agrostology, $20,100, an increase of $2,000; Division of Pomology, $16,000; Office of Experiment Stations, $45,000, including $12,000 for the Alaska stations; Nutrition Investigations, $15,000; Public Road Inquiry, $8,000; Division of Seeds, $130,000; Experimental Gardens and Grounds, $30,500, an increase of $8,000; Domestic Sugar Production, $7,000; Division of Accounts and Disbursements, $16,300; Library, $11,960; Museum, $2,500; furniture, cases, and repairs, $10,000; postage, $2,000; contingent expenses, $25,000.

In addition to the increased appropriations in many lines, the Department has been provided with a tract of land located near by to be used as a testing ground. This will afford facilities which the Department has long needed and will be a valuable acquisition to its equipment.

INVESTIGATIONS ON THE METABOLISM OF MILCH COWS.

OSCAR HAGEMANN, Ph. D.,

Professor at the Agricultural Academy, Poppelsdorf, Germany.

The theories concerning the processes in the animal body covered by the term metabolism have undergone many changes, and although much has been learned regarding them, they will undoubtedly be still further changed as investigation progresses and methods are improved. The earliest investigations of this sort were made with man. The weight of the food and drink was determined, as well as the weight of the material excreted in the urine, feces, and respiratory products. These investigations were carried on by Sanctorius and published in 1614.[1]

Further progress was impossible until the science of chemistry had been elaborated, and this required 150 years. The most important advancement was in knowledge of the character of different gases. Van Helmont (1644) discovered carbon dioxid and also found that the air expired by man and animals was injurious. In 1757 Black identified carbon dioxid in respired air. Priestly and Scheele discovered oxygen in 1774–75; and Lavoisier established the relation between oxygen and combustion, and in 1777 published his classic investigations,[2] showing that when the vital processes take place in the human body oxygen is consumed and carbon dioxid excreted, in the same way that combustion takes place in a furnace. He held the opinion that with the aid of the food a fluid rich in carbon and hydrogen was formed in the lungs. This was constantly renewed, and united with the oxygen to form heat, water vapor and carbon dioxid being produced at the same time. Lavoisier also determined the effect of muscular work, food, and low temperature on the consumption of oxygen.

The investigations of Lavoisier and his associate, Sequin, may be said to mark an epoch in animal metabolism. Levoisier's theory of pulmonary combustion was incorrect, but more exact knowledge was impossible at that time, since the fact that the animal body is made up of cells was not discovered until many years after his death.

We are still further indebted to Lavoisier for the methods of elementary analysis. Among other things, this rendered possible the determination of the elementary composition of the food, urine, and feces,

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[1] De Medicina Statica Aphorisimi, Venice.

[2] Sur la respiration des animaux et sur les changements qui arrivent a l'air en passant par leur poumon.

and permitted investigations based on other data than the study of the gaseous excretory products.

Progress was hindered by the lack of a proper standard for comparing the processes which take place in the animal body. The development of organic chemistry and the isolation of a number of well characterized chemical compounds which occur in the food and excretory products furnished Liebig the foundation for his theories. He divided nutrients into nitrogenous (plastic) and nitrogen-free (respiratory) materials.

To Voit and his fellows belongs the credit of discovering the importance of protein as a nutrient, *i. e.*, that the animal requires daily in the food a definite amount of nitrogenous material in order to sustain life. The protein is broken down in the body at the same time the processes of combustion are carried on, and eventually the animal comes into nitrogen equilibrium. Nitrogen equilibrium can be reached when only protein is consumed, provided the amount is very large, but it can be attained with a much smaller amount if fat and carbohydrates are consumed at the same time. If the animal performs work, accumulates flesh and fat, or produces milk or wool, or nourishes a fetus, more protein must be consumed than for maintenance or an equivalent amount of nitrogen-free nutrients or both must be supplied. If work is performed nitrogen-free material is essential, if flesh is formed then protein is required.

Voit defined nutrients as materials which build and repair the animal body. This definition includes mineral matter and water.

In investigations which have proved most useful for an understanding of the processes of metabolism, the total income and outgo have been taken into account. The elementary composition of the food, urine, and feces has been determined, the respiratory products have been measured and analyzed, and finally the oxygen consumed has also been measured. The principal investigations along these lines were made by Bidder and Schmidt, Pettenkofer and Voit, Henneberg and his followers, Regnault and Reiset, and Pflüger and his associates.

It is interesting to note some of the changes in theories of animal feeding which have accompanied the growth of the knowledge of nutrition. In this connection two points have always been of importance and are important to day. The practical feeder (1) wishes to know the cost of a method of feeding and the profit it will return, and (2) he desires definite feeding standards or formulas which can be successfully followed. In the early part of the present century feeding stuffs were first examined on the basis of their content of protein, starch, gluten, sugar, gums, mineral matters, etc. As these materials were regarded as of equal value, it was customary to add them together and regard the sum as the measure of the nutritive value of the feeding stuff. The chemical methods followed were not exact, and for this and other reasons the system was of little value.

Boussingault called attention to the importance of the nitrogen content of feeding stuffs, and believed that this alone could be taken as a basis for estimating their value. On the other hand, Haubner showed that nitrogen-free material was useful for building up the animal body. Nathusius showed that the woody fiber was to a certain extent injurious; and Boussingault finally modified his theory so that on the basis of the nitrogen content feeding stuffs were divided into 4 classes: (1) Hay and straw, (2) roots and tubers, (3) oil-bearing seeds, and (4) grains, leguminous seeds, and oil cakes.

The attempt was also made to compare feeding stuffs in a practical or empirical manner by means of tables showing the so-called "hay values," or the hay equivalent of different materials. Thus it was said that $16\frac{2}{3}$ kg. hay equivalent was required per 1,000 kg. live weight for maintenance by cattle or sheep. If the food supplied more than this, each kilogram consumed in excess would produce a gain of 0.1 kg. body material or fetus or 1 liter of milk. However, one hay differs from another and other feeding stuffs also vary in composition, and as a result there were soon a considerable number of "hay value" tables from which it was impossible to select the correct one. An improvement was suggested by E. Wolff, who took account of the chemical composition of feeding stuffs and considered crude fiber as indigestible. Thus it was said that normal hay should contain 8.2 per cent of protein, 41.3 per cent of soluble nitrogen-free material, and 30 per cent of crude fiber, with a nutritive ratio of 1:5. This modification did not prove of much value since crude fiber is partially digestible, and, further, the soluble nutrients in different feeding stuffs have different nutritive values and different digestibility. The convenient theory of hay values was therefore abandoned and experiments were undertaken with different kinds of animals to learn how much protein, soluble nitrogen-free material, and fat must be fed for different purposes.

Grouven's normal feeding standards, which were published in 1862, were determined by this method. They were a great improvement on the tables of hay values, and superseded them. These standards were a series of formulas based on experiments depending in part on the general appearance of the subject, and on results of slaughter tests. Grouven also made many investigations, including digestion and respiration experiments, for the purpose of determining the nutritive value of a number of simple nutritive materials, such as sugar, starch, and dextrin.

A curious theory was devised by Enzmann in 1866.[1] He determined the ratio of carbon to nitrogen in different feeding stuffs, designating it the "specific carbon content," and on this basis arranged materials as follows: Rice straw 117, potatoes 34, hay 27.4, red clover hay 17.4,

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[1] Landw. Vers. Stat., 8 (1866), pp. 309, 320. For earlier work see Die Ernährung der Organismen besonders des Menschen und der Thiere im hungernden Zustande. Dresden: C. C. Meinhold & Söhne, 1856.

peas 11, cows' milk 8, lupines 7.8, lean meat 4, blood 3.5, protein 3.4. He taught that the food must supply an animal with the specific carbon value suited to its age. Thus, a sucking calf required a specific carbon value of 8, since the value of milk was 8. The value was greater for older animals. For cattle, horses, and sheep it was between 24 and 44, for swine 26, and for milch cows 24. This theory was based entirely on speculation and has never been followed practically.

Finally an attempt was made to learn how much of the different feeding stuffs was required by trusting the instincts of the animals when given the choice of materials. Thus, a milch cow was given the choice of oil cake, fodder beets, hay, and straw. The amount of each consumed was determined. Such investigations were made by Haubner and he soon showed that the method was too costly to be of any practical benefit.

About 1860 Bischoff and Voit made their classic investigations on nitrogen equilibrium and formulated the laws of growth for Carnivora. Instead of depending on the body weight to show whether a ration was sufficient, the nitrogen excreted in the urine was determined, and further, the excretion of carbon dioxid in the respiratory products was measured by a suitable respiration apparatus. An animal was said to be in equilibrium when the nitrogen and carbon in the excretory products equaled the amount consumed in the food, due account being taken of the amounts of carbon and nitrogen lost in epitheliel cells, sweat, mucus, hair, nails, hoofs, and horns. These investigations were at first made with Carnivora only, mainly with dogs and cats, but later were carried on with man. It was much simpler to study the laws of nutrition with Carnivora than Herbivora since their diet is comparatively simple, the urine is easy to collect and analyze, when fed once a day the feces are excreted daily, and the food does not remain in the intestinal tract longer than 24 hours. Such experiments with Herbivora, and especially with ruminants, are attended with much greater difficulties. Nevertheless Henneberg, Stohmann, Grouven, and others have shown that with ruminants also the general laws of nutrition hold good. Such investigations are being carried on at the present time, and have furnished a large amount of useful information. However, much still remains to be studied.

E. Wolff has devoted many years to determining the coefficients of digestibility of feeding stuffs by sheep and horses. Kühn in Möckern and his successor, Kellner, and many others have devoted much time to methods of analysis of feeding stuffs and methods of metabolism experimenting, with a view to establishing a rational basis for animal feeding. A number of the agricultural experiment stations have devoted much attention to these subjects and have made many determinations of the digestibility of different foods by various animals.

Recently in addition to proximate analyses of the food and feces and determinations of nitrogen in the urine, calorimetric experiments have been undertaken, and the balance of income and outgo of energy

attempted in addition to that of nitrogen and carbon. Samples of food, urine, and feces are burned in a Berthelot bomb in an atmosphere of oxygen under pressure. In this way the total energy—*i. e.*, heat of combustion—may be determined. The fuel value of the food less the fuel value of the feces gives the fuel value of the food digested. This amount, less the fuel value of the urine, gives the fuel value available for the body. If the income of energy is greater than the outgo, the ration is more than sufficient for maintenance. Kellner published the results of such experiments with cattle about 2 years ago. However, as early as 1880 he called attention to the importance of calorimetric investigations of this nature.

Another important factor upon which information is essential is the amount of energy which is expended in digesting food. An idea of its importance may be gathered from an experiment which was undertaken by Zuntz and the writer with a horse. It was found that the horse digested 391 gm. of fiber-free nutrients from a kilogram of hay and 615 gm. from a kilogram of oats. Therefore, according to the usual method of comparison, hay : oats : : 391 : 615, or in round numbers, as 2 : 3. This deduction, however, is not warranted. A kilogram of hay requires for chewing and digesting an expenditure of energy equivalent to 209 gm. of fiber-free nutrients, and a kilogram of oats an amount equal to 124 gm. This energy is eventually transformed into heat and supplies wholly or in part the warmth required by the animal body, so that as regards maintenance hay and oats may truly be said to stand in the ratio of 2 : 3. But if the ration is in excess of the amount required for maintenance, for instance, if work is to be performed, then the ratio is as follows: Hay : oats : : 391 — 209 : 615 — 124, or 182 : 491, or in round numbers 1 : 2.7. That is, 2.7 kg. instead of 1.5 kg. of hay is equal to 1 kg. of oats.

EXPERIMENTAL METHODS.

In metabolism experiments it is absolutely necessary to collect the urine and feces and determine the amount and composition of each. The nitrogen in the urine is always determined, and often the carbon, hydrogen, and mineral matter. It is usually necessary to dry the feces before analysis. The same determinations are then made as in the urine, and, in addition, proximate analyses corresponding to the determinations made in the food. In the case of large domestic animals, milch cows, for instance, it would be very inconvenient to retain all the feces for analysis, since they may amount to 20 or 30 kg. daily. Therefore aliquot samples should be taken each day and dried and united for analysis. The materials excreted each day in the feces can then be calculated. In the case of steers, the collection of the urine is a comparatively simple matter, and special apparatus has been devised for this purpose. In the case of cows, the usual plan is to watch the animals day and night and collect the urine directly in suitable vessels. Sometimes animals are kept in a stall with a grating in the floor through

which the urine can flow. It is then collected, together with the water used to rinse the floor and receptacles. In experiments with sheep and swine the feces are often collected in a suitable sack attached to the animal, though this precaution is not always taken. The difficulty of separating and collecting the urine and feces with milch cows perhaps accounts for the relatively small number of metabolism experiments with them.

An experiment of 5 days' duration was made by Voit in Munich, and one of 8 days' duration by Fleischer in Hohenheim. In both cases the excretory products were collected in suitable vessels by the assistants watching the cows. In 1869 Kühn and Fleischer, at Möckern, devised an apparatus for experiments with cows which permitted a satisfactory collection of the urine, but did not provide for the collec-

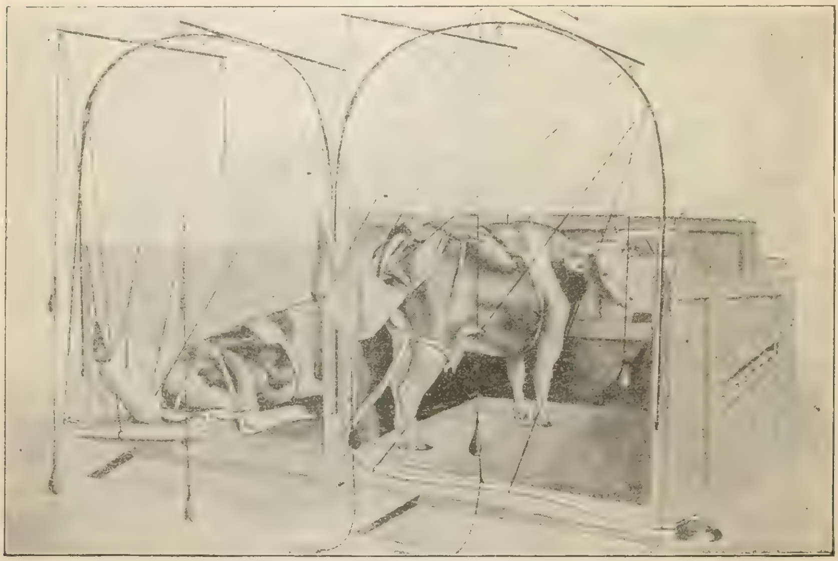

FIG. 15.—Apparatus for use in digestion experiments with cows.

tion of the feces. In 1894 the writer devised apparatus for use in experiments with cows which insures the separation and collection of the urine and feces. It is attached to the cow by means of a band around the body. A system of pulleys and bands holds the apparatus in position when the cows are lying down or standing. The device is illustrated in the accompanying figures.

In metabolism experiments it is essential to determine the amount of urine and feces excreted per day, rather than the total amount excreted, since this alone offers a means of judging of the cleavage processes which take place in the body. In the case of experiments with dogs each day's urine may be easily collected by means of a catheter, but with large animals, such as steers, this is hardly practicable. In the case of man and some animals the feces may be separated with char-

coal, cork dust, or berry seeds taken with the last meal before and the first meal after the period under investigation. In experiments with Herbivora, owing to the lack of suitable methods of separating the feces it is customary to delay the collection of the excretory products until the food under investigation has been consumed for from 2 to 3 weeks, since it may be assumed that digestion and excretion then take place regularly, and that the stomach and intestinal tract of the animal at a given time will contain the same amount of material. It is essential that the animals be fed regularly and given like amounts of food and water each day. In the case of the urine it is assumed that under ordinary circumstances no considerable quantity is retained in the bladder.

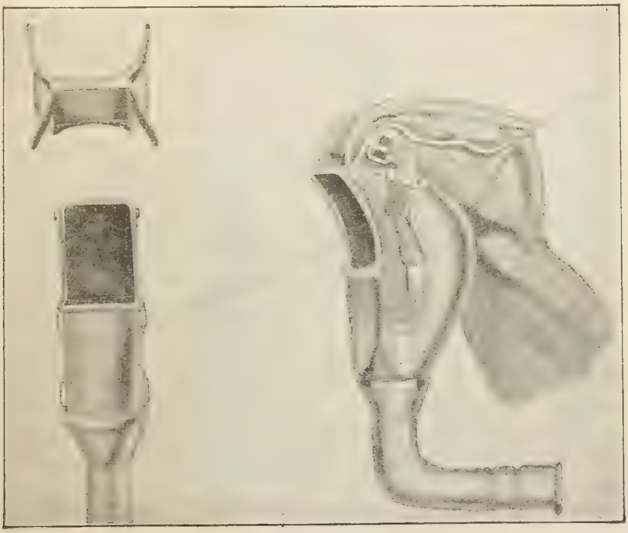

FIG. 16.—Parts of apparatus for use in digestion experiments with cows.

A metabolism experiment with milch cows should be conducted as follows: A preliminary period of 3 weeks should precede the experiment proper. The floor of the stall is then thoroughly cleaned. The device described above is attached to the cow and the time noted at which the last urine and feces were excreted. Suppose, for instance, that urine was excreted at 1.20 p. m., March 25, 1898, feces at 2.50, and the apparatus was attached at 3 p. m. The urine and feces are then collected for from 8 to 14 days and the time at which the experiment is discontinued is noted, together with the time of excretion of the last urine and feces. Suppose this in the case of urine to have been 4.40 p. m. and in the case of feces 2.30. Then the urine has been collected for 10 days $3\frac{1}{3}$ hours and the feces for 10 days lacking one-third of an hour. In calculating the daily excretion suitable correction must be made for fractional days.

Proper means must be taken for preventing fermentation of the excretory products when they are retained for analysis. To this end the feces should be removed as soon as possible from the bag in which they are collected, and should be weighed, sampled, and dried at once. In winter the cold weather prevents the fermentation of the urine. In summer a known quantity of preservative material—for instance, sulphuric acid, formic aldehyde, or thymol—may be added to the urine. The apparatus for collecting the urine must be rinsed at least once in 48 hours with a disinfecting solution (10 per cent formic aldehyde), and afterwards with pure water. When only the nitrogen in the urine is determined it is a matter of indifference which preservative is used. If the carbon is also determined then the use of sulphuric acid or cold storage must be resorted to, since both formic aldehyde and thymol contain carbon. If the mineral matter is also to be determined then sulphuric acid can not be used and a low temperature is the only method available.

Care must be taken that all the food is eaten or that the uneaten residue is weighed. The same precaution applies to water also.

During the preliminary period the weight of the animal should be accurately determined daily. During the experiment proper this factor may also be determined if the urine and feces are collected as soon as they are excreted. However, it is not a matter of great importance to determine the weight during this period unless it is long. When the weight remains constant for 2 or 3 months, or when it slowly increases or diminishes during such a period, this factor is of importance in drawing deductions. Otherwise the variations in water content of the intestinal tract, and hence the excretion of a larger or smaller quantity of feces on a given day, render this determination unreliable. Aside from such irregularities an animal may lose fat and flesh daily—that is, be in a condition of partial starvation—while the body weight remains constant or even increases. This is the case when the fatty tissue and protein (cells and cell contents) are broken down and replaced by water. In other words, if the experimental period is short a loss of body material may be covered by the large gain of water. The converse is also true. An animal poor in flesh but with a high water content may gain flesh and fat and at the same time lose weight owing to a diminution of the water in the tissues.

ANALYSIS OF THE MATERIALS.

In the analysis of the total food, the uneaten residue, and the feces it is important to determine the amount of sand and pure ash (including silica) in addition to the total ash. The sand mixed with the food passes through the animal undigested, and if the amount consumed is recovered it is an indication that the analytical work is to be depended upon.

Organic material in food and excretory products is made up of nitrogenous and nitrogen-free substances. The former include protein,

amids, alkaloids, and other chemical bodies of little importance in nutrition. The nitrogen-free material includes fat, soluble carbohydrates, and crude fiber. The methods employed in determining these substances are well known. Those employed by the writer are described at length by König in his book on agricultural and commercial analysis.

The estimation of water is of especial importance. If the material is dried in the air at 105 to 110° C., the results may be too high, owing to the expulsion of too much water and in some cases to an oxidation of the fat. The water driven off under these conditions may be of 4 kinds: (1) The hygroscopic water on the surface of the substance and in the capillary spaces or the residue from the former cell fluid, (2) water which held the same relation to the separate constituents of the cell as the water of crystallization of an inorganic salt, (3) water formed at this temperature by the union of oxygen and hydrogen within the organic molecules, and (4) water formed by the action of the oxygen of the air on the hydrogen of the substance. It is possible also that some of the carbon may be oxidized to carbon dioxid.

The term "dry matter" can properly be applied only to substances from which water included under 1 and 2 has been removed. It has been the writer's practice to dry all materials in a current of dry illuminating gas. Drying need not be continued longer than 24 hours at 70° to attain constant weight, provided a sufficient quantity of gas can be drawn through the apparatus without increasing the pressure. Many substances—oil cakes, for instance—lose material other than water when heated to 70°. In such cases the drying must be continued for more than 24 hours at from 40 to 50°. The receptacle in which the substance to be dried is weighed consists of 2 parts which fit together very closely, so that moisture is not absorbed during weighing. It is a matter of the utmost importance in metabolism experiments to estimate the dry matter in food, urine, feces, milk, etc., by a uniform method. Urine and milk may easily be dried in 3 days over a sufficient quantity of sulphuric acid (100 times as much as the dry matter), if mixed with kaolin, pumice stone, or sand.

Sampling for analysis is a matter of great importance. This is comparatively simple with milk, urine, and ground concentrated feeding stuffs, such as cotton-seed meal or ground peanut cake. It is more difficult in the case of feces and such materials as whole or coarsely ground grains. Two samples at least should be taken of such materials. Sampling is most difficult in the case of coarse fodders, and it is advisable to take 3 samples. In sampling hay, straw, etc., the material may be divided into bundles, and each bundle passed through a cutting machine, like portions being retained from each bundle. These portions should be thoroughly mixed and samples for analysis taken from the mixture.

Suppose 6 metabolism experiments are to be made with 2 cows. Each experiment requires a month. The 2 cows in 6 months would

require about 2,200 kg. of hay and 750 kg. of straw. Therefore this amount of material must be procured and so preserved that its moisture content will not be changed during the experiment. Three to 5 per cent of the material (66 to 110 kg. of hay and 22 to 38 kg. of straw) should be taken for sampling. The hay or straw should be spread out in an even layer on paper or suitable material and portions taken here and there. These portions should in the same way be mixed and spread in an even layer and from the mixture final samples taken for analysis.

In experiments with cows it is necessary to determine the nitrogen in the fresh feces, since nitrogen is lost if the material is dried. The Kjeldahl method is used for this purpose. The fat may be determined in the usual way, using ether distilled over sodium. The crude fiber should be determined by heating the substance in autoclaves at 3 atmospheres pressure in glycerin-sulphuric acid (20 gm. sulphuric acid to 1 liter glycerin).

An elementary analysis may be combined with determination of the heat of combustion of different materials by collecting the resulting gas in the bomb, measuring it, and analyzing small portions.

BALANCE OF INCOME AND OUTGO.

In accurate metabolism experiments, in addition to the determinations noted above, it is necessary to measure the carbon dioxid excreted in the breath. It is also desirable to measure the oxygen consumed from the air, although fairly accurate results may be obtained when only the carbon dioxid is measured, as is done with the Pettenkofer respiration apparatus.

When protein, fat, and carbohydrates are the only materials utilized in the animal body, as is the case with Carnivora, determining the outgo of carbon in addition to the nitrogen in the urine is sufficient. Thus, in an experiment with a dog the urine was found to contain 17 gm. of nitrogen and 14.3 gm. carbon and the respired air 160 gm. carbon per day on a diet of protein and fat in one instance and of fat and starch in another. As protein contains 16 per cent of nitrogen and 53 per cent of carbon—*i. e.*, in the proportion of 16 to 53—the 17 gm. of nitrogen would call for 56.3 gm. carbon. Of this, 14.3 gm. was found in the urine, leaving 42 gm. of carbon to be ascribed to the protein broken down in the body. Since 160 gm. carbon was excreted in the respired air, 118 gm. (160 − 42) must have been derived from starch or fat. Animal fat is fairly uniform in composition, containing in round numbers 77 per cent carbon, 12 per cent hydrogen, and 11 per cent oxygen, while starch contains 44.4 per cent carbon, 6.2 per cent hydrogen, and 49.4 per cent oxygen; that is, 153 gm. fat or 266 gm. starch would furnish 118 gm. carbon.

If the dog is fed with both fat and starch in addition to protein, it is not possible to calculate the amount of fat and of starch broken down in the body by determining the amount of carbon dioxid excreted in addition to the nitrogen in the urine. In this case the amount of oxygen consumed must be known in addition. This may be calculated. It is not probable that the animal body can use protein when fed in connection with fat and starch more economically than protein from its tissues when fasting. Voit found that the organic matter excreted in the urine of a fasting dog was made up of 25.5 per cent carbon, 6.4 per cent hydrogen, 34.4 per cent nitrogen, and 33.7 per cent oxygen. If 100 gm. of protein were broken down in the body 16 gm. of nitrogen would be found in the urine, together with carbon, hydrogen, and oxygen. The data for calculating the amount of oxygen required for the combustion of protein and the amount of carbon dioxid produced from protein are therefore available. Suppose that 100 gm. protein is consumed and 46.6 gm. organic matter excreted in the urine. Then—

100 gm. protein consumed	=53.0 gm. C,	7 gm. H,	16 gm. N,	23.0 gm. O,	1 gm. S
46.6 gm. organic material in urine	=11.9 gm. C,	3 gm. H,	16 gm. N,	15.7 gm. O,	
Remainder....................	=41.1 gm. C,	4 gm. H,		7.3 gm. O,	1 gm. S

The C, H, and S will be oxidized to CO_2, H_2O, and SO_3. The oxidation of 41.1 gm. C would produce 150.7 gm. CO_2. This would require 109.6 gm. O; 4 gm. H would produce 36 gm. H_2O and require 32 gm. O; 1 gm. S would produce 2.5 gm. SO_3, requiring 1.5 gm. O, or a total of 143.1 gm. of oxygen. Deducting from this amount 7.3 gm. O furnished by the food in excess of the amount excreted in the urine, leaves 135.8 gm. of oxygen as the amount which must be taken by the body from the inspired air. As noted above, the expired air contained 150.7 gm. CO_2. One liter of carbon dioxid weighs 1.96633 gm. and 1 liter of oxygen 1.43003 gm. at 760 mm. mercury pressure. The respiratory quotient—that is, the ratio of carbon dioxid produced to oxygen consumed—would be as follows:

$$\frac{CO_2}{O_2}=\frac{150.7 \div 1.96633}{135.8 \div 1.43003}=0.807$$

If 17 gm. of nitrogen were excreted in the urine, as mentioned above, then the amount of carbon dioxid produced by the combustion of protein in the body would be as follows:

$$\frac{17 \times 150.7}{16}=160.1 \text{ gm. } CO_2 \text{ (containing 43.7 gm. C).}$$

The amount of oxygen necessary would be:

$$\frac{17 \times 135.8}{16}=144.3 \text{ gm. O.}$$

Supposing the animal took 500 gm. of O from the air and excreted 160 gm. CO_2 in the breath, the amount of carbon which must have

been derived from some substance other than protein—that is, from fat and carbohydrates—is shown as follows:

160 gm. C (excreted in breath) —43.7 gm. (derived from protein) = 116.3 gm. (derived from fat and starch).

500 gm. O (amount consumed) —144.3 (amount necessary for oxidation of protein) = 355.7 gm. O (amount for oxidation of carbon from fat and starch).

The proportion of fat and starch burned in the body may be determined by studying the respiratory quotient. Ordinary animal fat has the following percentage composition: 76.54 carbon, 12.01 hydrogen, 11.45 oxygen. When 100 gm. fat is burned 11.45 gm. oxygen and 1.43 gm. hydrogen unite to form water, and there remain 10.58 gm. hydrogen and 76.54 gm. carbon. These require 84.64 gm. and 204.11 gm. oxygen, respectively, or a total of 288.75 gm. for complete combustion, 280.65 gm. CO_2 being produced. This oxygen must be derived from the air. The respiratory quotient would therefore be

$$\frac{280.65 \div 1.96633}{288.75 \div 1.43003} = 0.7069$$

Starch has the formula $(C_6H_{10}O_5)_x$. Its molecular weight is therefore some multiple of 162. The oxygen in the starch molecule is sufficient for a complete combustion of the hydrogen; therefore only an amount sufficient for the combustion of the carbon need be taken from the air. The carbon in 162 gm. of starch would require 192 gm. of oxygen for its combustion and produce 264 gm. carbon dioxid. Therefore the carbon in 100 gm. would require 118.5 gm. oxygen, producing 163 gm. carbon dioxid. The respiratory quotient when starch is burned is therefore 1. If a respiratory quotient of 1 is found in an experiment, then starch alone is burned in the body. A respiratory quotient of 0.7069 shows that fat only is burned. If the respiratory quotient is between these values, it indicates the combustion of a mixture of fat and starch.

The amount of oxygen necessary for combustion may be computed as follows:

Let A = total O used, $B = CO_2$ produced, and X = O necessary for oxidation of fat. Then $A - X$ = O available for oxidation of starch; and $X \times 0.7069 + (A - X) \times 1 = B$ (the CO_2 produced).

In the concrete example cited above there were 116.3 gm. of carbon (equal to 216.9 liters of carbon dioxid) and 355.7 gm. (equal to 248.7 liters) of oxygen remaining to be accounted for by combustion of fat and starch. The respiratory quotient would therefore be 0.872.

Substituting the proper values in the above equations would give the following:

$0.7069\,X + 248.7 - X = 216.9$. Then $X = 108.5$, the oxygen necessary for oxidation of fat; and $248.7 - 108.5 = 140.2$, the oxygen necessary for oxidation of starch.

From the above data the metabolism of energy in the animal body can be calculated. One gram of protein burned in a calorimeter produces 5.711 calories (mean of Berthelot and Stohmann's determinations). Combustion in the animal body is less complete since nitrogen is excreted largely in the form of urea, therefore less energy is produced. According to Rubner 1 gm. of dry matter of ash-free protein of tissue burned in the body of a fasting animal yields 4.4 calories. Provided the animal is amply nourished, substances containing more carbon and having a higher fuel value than urea are excreted in the urine, therefore the energy available from the combustion of protein is still less. The true value in such cases can not be calculated with certainty, but must be determined by accurate investigation in the individual experiments. In most cases it is sufficiently accurate to assume that 1 gm. of protein yields 4.1 calories when burned in the body.

The heat of combustion of a gram of fat is 9.5 calories and of 1 gm. of starch 4.18 calories. As noted above, the combustion of 100 gm. of fat requires 288.75 gm. or 201.9 liters of oxygen. Each liter of oxygen utilized for the combustion of fat produces 4.7 calories ($950 \div 201.9 = 4.7$); 100 gm. of starch requires for oxidation 118.5 gm. or 82.9 liters of oxygen. Therefore each liter of oxygen used in the oxidation of starch produces 5 calories ($418 \div 82.9 = 5$).

In the example cited above the total energy produced would be 1,646.6 calories, calculated as follows:

		Calories.
$\frac{100 \times 17}{16} = 106.25$ gm. protein burned in the body.	106.25×4.1 .... =	435.6
The oxidation of fat requires 108.5 liters oxygen.	108.5×4.7 .... =	510.0
The oxidation of starch requires 140.2 liters oxygen.	140.2×5 .... =	701.0
Total..		1,646.6

In this computation no account is taken of the fact that in addition to protein other nitrogenous materials, amids for instance, were consumed, which also produce nitrogenous compounds in the urine but of less fuel value than the compounds derived from protein. Further, when large quantities of fat and starch are consumed fat will be stored in the body. The amid nitrogen in the urine may be treated as nitrogen derived from protein without serious error, since the assumption is made that 46.6 gm. organic material in the urine is derived from the cleavage of 100 gm. protein, and further since the fuel value of protein is assumed to be 4.1 calories per gram. For very accurate investigations, however, the above factors an not be used and actual determinations of the values must be made.

If the food is very abundant the formation of fat from starch is accompanied by cleavage of carbon dioxid from the starch molecule. Deducting the values for the oxidation of protein the respiratory quotient in the case becomes greater than 1. That is, the total quantity of oxygen available for the oxidation of nitrogen-free material should be assumed

to be used for the oxidation of starch. The excess of carbon dioxid must be attributed to the formation of fat from starch. These facts are more clearly brought out in the following equation:

100 gm. fat will yield 950 calories.

100 gm. starch will yield 418 calories.

The greatest possible quantity of fat which can be formed from 100 gm. starch is 44, since $418 \div 9.50 = 44$.

100 gm. starch contains	44.44 gm. C, 6.18 gm. H, 49.38 gm. O
44 gm. fat contains	33.68 gm. C, 5.28 gm. H, 5.04 gm. O
Difference	10.76 gm. C, 0.90 gm. H, 44.34 gm. O

For oxidation there is required 28.69 gm. O + 7.20 gm. O = 35.89 gm. O.

The oxidation products are: 39.45 gm. CO_2 and 8.10 gm. H_2O.

Excess: 8.45 gm. O. $(44.34 - 35.89 = 8.45.)$

This quantity of oxygen is available for the oxidation of further quantities of starch. It would oxidize 7.13 gm. starch $(162 \div 192 \times 8.45 = 7.13)$. This would yield 29.8 calories $(7.13 \times 4.18 = 29.8)$ and 11.62 gm. carbon dioxid. That is, from 107.13 gm. starch 44 gm. fat can be produced, together with 51.7 gm. or 26 liters carbon dioxid and 29.8 calories. In other words, when the respiratory quotient is greater than 1, each liter of carbon dioxid in excess of the quantity of oxygen required is equivalent to 1.694 gm. fat and 1.15 calories.

[Concluded in next number.]

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The oil of corn, C. G. HOPKINS (*Jour. Amer. Chem. Soc., 20 (1898), No. 12, pp. 948–961*).—The author reports a systematic study of corn oil obtained partly by extraction and partly from starch and glucose factories. Determinations were made of the specific gravity, melting point, iodin absorption, and oxygen absorption of the oil and of the content of lecithin, cholesterol, total fatty acids, volatile acids, and the separate fatty acids. The method of operation is described in each case. The total fatty acids were found to constitute 93.57 per cent of the oil. A summary of the composition of corn oil, as found in this investigation, is as follows:

Composition of corn oil.

	Per cent.
Cholesterol	1.37
Lecithin	1.49
Stearin (?)	3.66
Olein	44.85
Linolin	48.19
Total	99.56

It was found that corn oil does not take up any oxygen at room temperature, but when heated in a water oven changes in weight were noticed which have an important bearing on the determination of water in corn.

"The first action of air upon the hot oil is evidently the direct addition of oxygen; but after 2 or 3 days the oil began to turn noticeably darker in color and finally to lose weight, evidently due to a secondary reaction which effects some decomposition of the oil with formation of volatile products."

Proceedings of the eleventh convention of the Association of Agricultural Experiment Stations in the German Empire (*Landw. Vers. Stat., 51 (1898), No. 1, pp. 15–44*).—This reports, among other things, the action of the association on methods of analysis of Thomas slag and of examining seeds, and includes discussions on the preparatory training of station assistants, the allowable amount of perchlorate

in nitrate of soda, and changes in laws. Comparative tests by 19 stations of the molybdic and Böttcher citrate methods for determining the citrate-soluble phosphoric acid in Thomas slag are reported. As a result of this work, the citrate method was made optional, although in cases of dispute Wagner's molybdic method is to be used.

By applying the Loges method the Halle Station found in 107 samples of nitrate of soda from 0.27 to 5.64 per cent of perchlorate, averaging 0.94 per cent. The general occurrence of this substance in nitrate was shown by reports from other analysts. P. Wagner briefly reported results of pot experiments with different amounts of perchlorate on oats and rye. He found that the rye plants ceased to grow when the nitrate of soda used contained 12 per cent of perchlorate; the oat plants died when the amount reached 18 per cent.

No change was made in the methods of seed testing.

It seemed to be the consensus of opinion that the best preparation for station assistants consists in a good, general training in analytical chemistry, the necessary technical skill required being easily acquired in the laboratory.

A new solvent for distinguishing the phosphoric acid in various phosphates, W. HOFFMEISTER (*Landw. Vers. Stat., 50 (1898), No. 5-6, pp. 363-379*).—The author claims that humic acid furnishes a more reliable means of distinguishing between different phosphates than the citrate solutions commonly used. The humic acid is prepared as follows: Extract wood lignin with ammonia vapor, precipitate the humic acid in the ammoniacal solution with dilute hydrochloric acid, collect the precipitate on a filter, wash and dry. Extract with alcohol and again dissolve the humic acid in ammonia, precipitate, wash, and dry.

The method proposed for the examination of the phosphate is as follows: Dissolve 15 gm. of the humic acid in dilute ammonia[1] and pour the solution into a 2-liter flask containing some sand. Add 5 gm. of the phosphate and 1 liter of water; shake the contents of the flask and pass a moderately rapid current of carbon dioxid through the solution for 12 days, adding ammonia[1] frequently; pour off the solution; wash the sand; combine the wash water with the solution previously poured off; make up to a definite volume; filter, and evaporate four-fifths of the filtrate to dryness with the addition of hydrochloric acid; treat the residue with water containing a little hydrochloric acid; filter, wash, and make up the filtrate to 100 cc. Use portions of this solution for the determination of phosphoric acid, etc.

A slag containing 16.7 per cent of citrate-soluble phosphoric acid according to Wagner's method gave 10.43 and 10.38 per cent soluble in humic acid by the author's method. In bone meal and fermented bone meal 1.01 and 1.48 per cent of phosphoric acid respectively were dissolved in the humic acid. When the slag was very finely ground the two methods gave practically identical results—18.53 per cent by the

[1] The amount of ammonia to be used is not stated.

Wagner method and 18.48 and 18.45 by the author's method—thus showing the great importance of manufacturers supplying slag in the finest possible form.

Humic acid dissolved 95.8 per cent of the phosphoric acid in very fine ground slag, 30.38 per cent of that of Redonda phosphate, and 43.3 per cent of that in bone precipitate.

The determination of potash as perchlorate, F. S. SHIVER (*Jour. Amer. Chem. Soc., 21 (1899), No. 1, pp. 33–42*).—The solution of potash, after freeing from sulphuric acid and nonvolatile acids, is evaporated in a porcelain dish with an excess of perchloric acid until all odor of hydrochloric or other volatile acids has disappeared, and the white fumes of perchloric acid begin to appear. The sirupy solution is then treated with alcohol containing 0.2 per cent of perchloric acid, the precipitate washed by decantation, transferred to a Gooch crucible, washed with pure alcohol, dried, and weighed. The method is proposed as a check upon the commonly employed platinum chlorid method.—L. H. MERRILL.

A source of error in the determination of nitrogen in Chile saltpeter by the Ulsch method, L. BRANDT (*Chem. Ztg., 23 (1899), No. 3, p. 22*).—The author discovers an impurity in the iron used for his determinations in the form of an organic nitrogen compound, the nitrogen of which is converted into ammonia when the iron and sulphuric acid are brought together in the process. The error thus occasioned, he finds, amounts to as much as 0.8 per cent, when 0.5 gm. of Chile saltpeter is used in the determination. He announces this discovery to put other analysts on their guard.—J. T. ANDERSON.

Some errors in the determination of nitrogen, C. G. HOPKINS (*Jour. Amer. Chem. Soc., 20 (1898), No. 12, pp. 961–965*).—Two common sources of error were investigated, (1) the loss of ammonia in titrating in an open vessel, and (2) the loss of ammonia from the receiving flask in case there is not sufficient acid above the end of the delivery tube to neutralize all of the ammonia distilled over. In the first case it was found that when titration requires from 3 to 5 minutes the error from loss of ammonia from the standard solution may become an important factor, the total variation in the two series of experiments amounting to 0.6 cc. or 3 per cent of the ammonia required. In the second case the loss of ammonia was found to vary with the depth to which the delivery tube of the condenser dipped into the standard acid, in some cases amounting to a considerable proportion of the amount of ammonia theoretically required.

Report on an investigation of analytical methods for distinguishing between the nitrogen of proteids and that of the simpler amids or amido-acids, J. W. MALLET. **Separation of proteid bodies from the flesh bases by means of chlorin and bromin**, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Bul. 54, pp. 30*).—In the first part the classes of nitrogenous constituents in food and the

plan of the investigation are discussed, and a description is given of the various methods which have been proposed for the separation of proteid matter in animal products, with investigations of these methods.

"By a happy modification of the phospho-tungstic acid method he has greatly improved this process, and shown how a practical separation of the flesh bases from the other nitrogenous substances can be effected by this reagent. The flesh bases are to some extent precipitated by the new form of the reagent proposed by Professor Mallet, but they are brought into a soluble state by the addition of water and heat, so that a practically complete separation of them is effected. This process, together with the use of tannic acid for the separation of peptones, leaves little to be desired in securing a practically complete separation of the nitrogenous matters."

In the second part H. W. Wiley describes in detail the method of separating proteid bodies from the flesh bases by the use of hot water followed by chlorin or bromin, which has recently been investigated in the laboratory of the Division of Chemistry and applied in a series of analyses of flesh products. The application of the bromin method to commercial meat extracts is discussed, and the factors for the calculation of total nitrogen are considered.

Investigations on the effect of the quality of the ether on the results of fat determinations in feed stuffs, T. METHNER (*Chem. Ztg., 23 (1899), No. 5, pp. 37, 38*).—Results are given which were obtained with the use of (1) ether purified by metallic sodium in the prescribed way, (2) ether thus purified plus varying amounts of absolute alcohol, and (3) ether which had been allowed to stand over caustic lime for 3 weeks and then distilled. The author concludes from these results that alcohol, in the amounts used, has no considerable influence on the amount of extract obtained, and that ether, purified by caustic lime, is pure enough for practical purposes.—J. T. ANDERSON.

A condenser for extraction work, C. G. HOPKINS (*Jour. Amer. Chem. Soc., 20 (1898), No. 12, pp. 965, 966, fig. 1*).—This condenser has the water tube inside, instead of in the usual form of a jacket, both the inlet and outlet being at the top of the condenser and the inlet tube extending to the bottom of the water tube. It is intended for use in fat extraction apparatus in place of the ordinary condenser, "mainly to avoid the constant trouble of having atmospheric moisture condense upon the outer surface . . . and run down over the extraction apparatus." The condenser may also be used in ordinary distillation and is less likely to break than the ordinary condenser.

Researches on chemistry and physiology, applied to agriculture, A. PETERMANN (*Recherches de chemie et physiologie, appliquées à l'agriculture. Brussels: O. Mayoly and J. Audictre; Liege: C. Desoer; Paris: G. Masson, 1898, vol. 3*).

Text-book of physiological chemistry, O. HAMMARSTEN (*New York: John Wiley & Sons, 1898, pp. 705*).—Authorized translation from the third German edition by J. A. Mandel.

The estimation of manganese by means of potassium permanganate, F. W. DAW (*Chem. News, 79 (1899), No. 2043, p. 25*).—See also note by H. Bearley in *Chem. News, 79 (1899), No. 2044, p. 47*.

Formaldoxin as a reagent for detecting small quantities of copper, A. BACH (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 6, pp. 363–365*).

Analytical studies of flour of different sorts, D. A. VAN BASTALAER (*Ann. Pharm., 1898, pp. 193–200, 246–256; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 1, p. 156*).—New reactions with picric acid, alcohol, tincture of iodin, and potassium hydroxid solution are described.

Detection and determination of gelatin in gums and food materials, A. TRILLAT (*Bul. Soc. Chim. Paris, 19 (1898), No. 24, pp. 1017–1019*).

Contribution to the determination of fat in milk, M. KÜHN (*Milch Ztg., 27 (1898), No. 48, pp. 755–757; 49, pp. 772–774; 50, pp. 789–791; 51, pp. 807, 808; 52, pp. 823–825; 53, pp. 835–837*).—A comparison of the Adams and various simpler methods for determining fat.

Pure or adulterated butter, P. VIETH (*Milch Ztg., 27 (1898), No. 53, pp. 833–835*).—This deals with the reliability of the Reichert-Meissl number as a means of determining adulteration of butter. Studies by the author in England in 1889–1891, and recently at the Dairy Institute at Hameln, are cited to show that normal butter may be so low in volatile fatty acids as to condemn it as adulterated, if this determination alone is depended upon. Caution is urged, but no specific means of detecting adulterated butter are suggested.

The analytical constants of American linseed oils, A. H. GILL and A. C. LAMB (*Jour. Amer. Chem. Soc., 21 (1899), No. 1, pp. 29, 30*).—The constants are given of 9 of the principal brands of linseed oil found upon the market.—L. H. MERRILL.

Examination of water: Chemical and bacteriological, W. P. MASON (*New York: John Wiley & Sons; London: Chapman & Hall, 1899, 1. ed., pp. V + 135*).

The microscopy of drinking water, G. C. WHIPPLE (*New York: John Wiley & Sons; London: Chapman & Hall, 1899, 1. ed., pp. X + 338*).

Wheat oil, G. DE NEGRI (*Chem. Ztg., 22 (1898), No. 92, p. 976*).—A study of the oil expressed from the germ of wheat.

Short handbook of oil analysis, A. H. GILL (*Philadelphia: J. B. Lippincott Co., 1898, pp. 139*).

A method of analyzing natural and artificial organic coloring matters, A. G. ROTA (*Chem. Ztg., 22 (1898), No. 44, pp. 437–442; abs. in Analyst, 24 (1899), Feb., pp. 41–47*).—The method covers the separation of different coloring matters and their detection. The abstract is quite full.

Apparatus for the saponification of fats, oils, etc., J. G. ANNAN (*Chem. News, 79 (1899), No. 2045, p. 51, fig. 1*).—This consists of an ordinary Erlenmeyer flask fitted with a cork with 2 holes, one to carry the condenser which is mostly within the flask, and the other to be closed by a piece of glass rod. The apparatus requires no attention after the saponification has been started. It is believed to have "some advantages over that generally used for saponifications, more especially in the determination of Koettstorfer's figure."—C. B. WILLIAMS.

Improved apparatus, J. C. SAMMIS (*Jour. Amer. Chem. Soc., 21 (1899), No. 1, pp. 42–45, figs. 2*).—An improved burette and an electric heater for use in ether extraction are described.—L. H. MERRILL.

Automatic burettes, A. W. STOKES (*Analyst, 24 (1899), Jan., pp. 4–6, figs. 3*).—The requirements of a perfect automatic burette are outlined, and several complex forms described.—E. B. HOLLAND.

An automatic burette, H. D. RICHMOND (*Analyst, 24 (1899), Jan., pp. 2–4, figs. 5*).—After a slight discussion of the subject, a special style is described in detail. This burette is filled from the bottom by a siphon from an overhead stock bottle using a three-way cock. The overflow runs into a small air chamber which in turn is connected by an ascending tube with the stock bottle.—E. B. HOLLAND.

BOTANY.

Transpiration into a saturated atmosphere, H. H. DIXON (*Proc. Roy. Irish Acad., 3. ser., 4 (1898), No. 5, pp. 627–635, figs. 2; abs. in Bot. Gaz., 26 (1898), No. 2, p. 149*).—The conclusions of the author, drawn from his experiments in saturated atmosphere, are as follows: The elevation of the water of the transpiration current when the leaves are surrounded by a saturated atmosphere is affected by pumping actions proceeding from the living cells of the leaves. Observations based on the drying back of branches furnished with dead leaves render it highly probable that the vital pumping actions of the leaves are partially or wholly responsible for the elevation of water even in an unsaturated atmosphere. These pumping actions are capable of raising water against an external hydrostatic pressure and in common with other vital actions they are accelerated by moderately high temperature and are dependent on the supply of oxygen. The cells adjoining the terminal portions of the water conduits appear to possess this activity, and in plants provided with water glands the pumping actions are not limited to the secreting tissue of these glands.

On the formation of proteids and the assimilation of nitrates by phænogams in the absence of light, U. SUZUKI (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 488–507*).—A number of experiments are reported with barley, *Phaseolus multiflorus*, and potato plants in which their ability to assimilate nitrogen and form proteid compounds in the dark was tested. The ability of these plants to assimilate nitrates in perfect darkness is affirmed, and it is stated that proteids can be formed from nitrates in perfect darkness when the conditions are favorable—that is, when sugar is present in the plant cells. When the available amount of sugar is insufficient, the reduction of nitrates and their assimilation does not take place. The intermediate product between nitrates and proteids is considered to be asparagin, and when the conditions of protein formation are imperfect this substance accumulates. The author concludes by commenting upon the investigations of a number of investigators on this subject.

The influence of gases and vapors upon the growth of plants, E. P. SANDSTEN (*Minnesota Bot. Studies, 2. ser., 1898, No. 1, pp. 53–68*).—A report is given upon a series of experiments conducted to test the influence of gases and vapors upon seeds and seedlings, growing shoots, resting bulbs, and upon plants growing in water cultures. The chemical materials used were alcohol, ammonia, carbon bisulphid, chloroform, ether, nitrous oxid, and oxygen. The various plants experimented upon were seeds and seedlings of maize, *Vicia faba*, and *Phaseolus multiflorus*. Dormant bulbs and corms of Arisæma, Narcissus, hyacinth, tulips, Freesia, and crocus. In the experiments with gases maize was grown in water cultures containing nutrient solutions. Duplicate experiments and controls were maintained for all the experiments and the results are tabulated.

From the tabulated material it appears that seeds of Phaseolus and Vicia will not germinate in an atmosphere containing 80 per cent of nitrous oxid. Seedlings of these plants will remain active for more than 24 hours in an atmosphere of commercial nitrous oxid, but no growth will take place. In some cases shoots exhibited accelerated growth after being kept in an atmosphere of free nitrous oxid, or where the amount of gas ranged from 25 to 100 per cent, but no growth could be detected during the experiments. Aquatic plants showed considerable increased growth in solutions saturated with nitrous oxid. Seeds germinated readily in atmospheres of free oxygen, but seedlings kept in such an atmosphere did not grow as rapidly as those in ordinary air. Growing shoots kept in an atmosphere containing 25 to 100 per cent of free oxygen remained unchanged for as long a period as 20 days, but upon removal slowly perished.

Vapors of ammonia when used in quantities not exceeding 1 to 24,000 are not harmful to the germination of seeds of Phaseolus. Seeds exposed for 9 days in glass chambers containing from 1 to 24,000 and 1 to 32,000 parts of ammonia germinated as freely as in the control experiments. On the other hand the seed of *Vicia faba* is very susceptible to the influence of this vapor, and specimens kept for 9 days in 1 to 28,000 of ammonia failed to germinate. Both the Phaseolus and Vicia seed kept for 9 days in an atmosphere containing 1 to 20,000 of ammonia failed to germinate. The growth of young seedlings of maize kept for 48 hours in a moist chamber containing 1 to 20,000 of ammonia was seriously retarded. Resting bulbs are not affected by being kept in atmospheres containing 1 part of ammonia in 5,000. Chloroform and ether have a very similar effect upon growth. Seedlings of maize kept in a moist chamber containing 1 to 10,000 parts of chloroform or ether showed a marked acceleration in growth after being removed from the moist chamber. An atmosphere containing 1 to 5,000 greatly retarded growth. Resting bulbs and growing shoots are equally susceptible and are killed after being exposed for 10 to 20 days in atmospheres containing 1 to 10,000 of either chloroform or ether. The carbon bisulphid in extremely small amounts proved injurious to all growing plants, although it was inoperative on resting seeds.

When used in quantities not exceeding 1 to 10,000, alcohol has no effect upon the growth of seedlings. If larger quantities are used the growth is retarded and the seedlings killed. Resting bulbs kept in an atmosphere containing 1 to 500 and 1 to 1,000 parts of alcohol grew, but the floral organs were dwarfed and the flower buds remained unopened.

The toxic action of a certain group of substances, R. H. TRUE (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 410*).—The author states that common salt and potassium nitrate have long been regarded as essentially lacking in toxic action, and operate only through their osmotic activity. In his experiments cane sugar was assumed to be a purely

osmotic agent, and the concentration which a number of filaments of Spirogyra survived after an exposure of 24 hours was regarded as the measure of osmotic action which the alga can endure. This was found to be about 0.75 gm. molecules per liter.

Assuming the action of the other substances studied, which were glycerin, potassium nitrate, and common salt, to be purely osmotic, the concentrations calculated are glycerin, 0.75 gm. molecules per liter; common salt, 0.47 gm., and potassium nitrate 0.45 gm. molecules per liter. The limit of contraction for glycerin lies at a concentration greater than that of the cell sap and probably causes death by osmotic action. The limits of concentration for potassium nitrate and common salt lie much below the point of the same osmotic action as the cell sap and consequently they exert a pronounced toxic influence upon Spirogyra.

The acquisition of atmospheric nitrogen, W. M. MUNSON (*Maine Sta. Rpt. 1897, pp. 114–140*).—A résumé is given of the more important literature relating to this subject. The author briefly describes experiments conducted at the station on the practical application of soil inoculation. A quantity of soja beans were planted in drills and with the seed a number of tubercles from the previous year's crop at the Connecticut Storrs Station were scattered. The plants from inoculated soils were more stocky and of darker color than those in adjacent rows. Those plants growing in the inoculated soils bore an abundant supply of tubercles, while the others bore none. Inoculated plants were taller and produced more abundant pods per plant than in those grown in the uninoculated soil.

A limited trial of Nitragin for the common pea was made in which there was no appreciable effect from the use of the material. Tubercles developed abundantly on both lots, which was rather to be expected since peas had been freely grown in the vicinity for many years.

A bibliography of some of the more important papers to which the author's attention has been called is appended.

The second annual meeting of the Society for Plant Morphology and Physiology, E. F. SMITH (*Amer. Nat., 33 (1899), No. 387, pp. 199–217*).—Abstracts are given of the papers presented at the second meeting of this society at New York, December, 1898.

Notes on plants of the season, F. L. HARVEY (*Maine Sta. Rpt. 1897, pp. 179–184, pl. 1*).—Brief notes are given of a number of weeds, and attention called to the potato blight, strawberry-leaf blight, quince rust, and a blighting of maple leaves which was due to the dry hot wind following moist warm weather when the leaves were growing rapidly and in consequence quite tender. Notes are also given on 3 species of the stinkhorn fungi—*Phallus dæmomum*, *P. impudicus*, and *Mutinus brevis*.

On the number of rice shoots, I. INAGAKI (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 415–420*).—The author has deduced a formula by which to ascertain the number of shoots to be expected from each grain in a given lot of seed, the variations due to variety, climate, soil, manure, cultivation, etc., being considered. When tested on about a dozen varieties of rice grown under varying conditions, the greatest variation observed was 2.7 per cent, the calculated number being that much too great.

The dichotomous group of Panicum in the Eastern United States, W. W. ASHE (*Jour. Elisha Mitchell Sci. Soc., 15 (1898), No. 1, pp. 22–62*).—The author comments on the confusion in this group, rearranges the species, and describes about 20 new species.

Studies in Cyperaceæ, T. HOLM (*Amer. Jour. Sci., 4. ser., 7 (1899), No. 3, pp. 171–183, figs. 5*).—Notes are given on *Lipocarpha maculata, L. argentea, L. sphacelata,* and *L. microcephala.*

A memoir on the Chlamydomonadineæ, P. A. DANGEARD (*Botaniste, 6. ser., 1899, Nos. 2–6, pp. 65–299*).

Contributions to the history of the india-rubber plant, E. GOEZE (*Wiener Illus. Gart. Ztg., 23 (1899), No. 1, pp. 15–24*).

The occurrence of copper in the plant world, G. B. FRANKFORTER (*Chem. News, 79 (1899), No. 2044, pp. 44, 45*).

Concerning the constituents of the seed of Pinus cembra, E. SCHULZE and N. RONGGER (*Landw. Vers. Stat., 51 (1898), No. 2–3, pp. 189–204*).

The constituents of the seed of Picea excelsa and its proteids, N. RONGGER (*Landw. Vers. Stat., 51 (1898), No. 2–3, pp. 89–116*).

The physiological action of certain plasmolyzing agents, R. H. TRUE (*Bot. Gaz., 26 (1898), No. 2, pp. 407–416*).—The author reports upon the physiological action on Spirogyra of various concentrations of cane sugar, glycerin, sodium chlorid, and potassium nitrate.

The effect of the electric current on plants, B. KLEIN (*Ber. Deut. Bot. Gesell., 16 (1898), No. 10, pp. 335–346*).—The stimulating effect of electric currents on a number of leaves and seedlings is shown.

On the effects of stimulative and anesthetic gases on transpiration, H. DIXON (*Proc. Roy. Irish Acad., 3. ser., 4 (1898), No. 5, pp. 618–626, fig. 1*).

The primary synthesis of proteids in plants, W. M. KOZLOWSKI (*Bul. Torrey Bot. Club, 26 (1899), No. 2, pp. 35–57*).—The author reviews the various hypotheses relative to the formation of proteids in plants, and states his own theory of their formation from lower nitrogenous combinations.

Formation of albumen in the generation of onion bulbs, W. ZALESKI (*Ber. Deut. Bot. Gesell., 16 (1898), pp. 147–151; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, p. 56*).—The author has determined a considerable increase in the proteid substance of bulbs of *Allium cepa* germinated in the dark, the percentage rising from 32 to as much as 52.5. The bulbs are said to contain a much smaller proportion of reserve proteids than the seeds. The amount of asparagin remains about constant, and the formation of proteids in the dark can not be said to be due exclusively to asparagin and glutenin.

Investigations on the sex organs and fruiting of Cycas revoluta, S. IKENO (*Jour. Col. Sci. Imp. Univ. Tokyo, 12 (1898), No. 3, pp. 151–214, pls. 8*).

Studies on the fecundation and embryology of Ginkgo biloba, S. HIRASÉ (*Jour. Col. Sci. Imp. Univ. Tokyo, 12 (1898), No. 2, pp. 103–149, pls. 3*).

Dimorphism in Australian cruciferous plants, R. TATE (*Trans. Roy. Soc. South Australia, 22 (1898), No. 2, pp. 122–124*).

The root tubercles of alders and the Eleagnaceæ, L. HILTNER (*Forstl Naturw. Ztschr., 7 (1898), No. 12, pp. 415–423*).—Notes are given on the tubercles on the roots of Alnus, Sheperdia, Hippophæa, etc., of the organism causing the swellings, their entrance through the root hairs, and their ability to assimilate atmospheric nitrogen.

Inoculation for leguminous plants, SALFELD (*Deut. Landw. Presse, 26 (1899), No. 13, pp. 120–121*).—A rather popular article on the object and results of soil inoculation for nitrogen assimilation.

Experiments with Alinit: An answer, GERLACH (*Fühling's Landw. Ztg., 48 (1899), No. 2, pp. 69, 70*).—This is a reply to an article on experiments with Alinit by Stoklasa, which immediately precedes it. The author cautions the farmers against the use of Alinit until it has been carefully and scientifically tested.

The use of Alinit in the culture of cereals, L. MALPEAUX (*Ann. Agron., 24 (1898), No. 10, pp. 482–492; abs. in Chem. Ztg., 22 (1898), No. 36, Repert., p. 313*).—Upon poor

sandy soils Alinit was without effect in increasing the harvest of cereals. Where humus compounds were abundant Alinit did increase the crop, but inoculations in ordinary or poor soils were without appreciable influence.

General methods in botanical microtechnique, J. H. SCHAFFNER (*Jour. Appl. Micros., 2 (1899), No. 1, pp. 225–227*).—This article treats of the preparation of botanical material for paraffin embedding.

Several crosses of spelt and wheat, P. H. STOLL (*Deut. Landw. Presse, 26 (1899), No. 1, p. 3; 4, p. 29; 8, p. 65; 11, p. 95, figs. 7*).—Crosses obtained by fertilizing Square Head wheat with pollen of Brown Winter spelt are described and illustrated.

Results of experiments in the cross breeding of cereals and peas, W. SAUNDERS (*Canada Expt. Farms Rpt. 1897, pp. 67–69*).—Notes on the work of cross breeding spring wheat, barley, oats, peas, and of wheat with rye at the Central Experimental Farm.

The king-devil weed, F. L. HARVEY (*Maine Sta. Rpt. 1897, pp. 185–191, pl. 1*).—Notes are given on the history and distribution of *Hieracium praaltum.* This weed is reported as a rather serious pest in 5 or 6 different localities in the State, and remedies are suggested for the possible destruction and prevention of the spread of this plant, which would in all probability prove a serious weed pest.

METEOROLOGY—CLIMATOLOGY.

Meteorological observations (*Massachusetts Hatch Sta. Met. Buls. 118, 119, 120, pp. 4 each*).—The usual summaries of observations and notes on the weather during October, November, and December, 1898. In addition, No. 120 gives an annual summary for 1898, the principal data in which are as follows:

Pressure[1] (inches).—Maximum, 30.76, March 26; minimum, 29.01, February 16; mean, 30.008. *Air temperature*[2] (degrees F.).—Maximum, 96.5, July 3; minimum, —19, February 3; mean, 47.5; mean sensible (wet bulb), 45.2; annual range, 115.5; maximum daily range, 40, February 3; minimum daily range, 2.5, April 5; mean daily range, 20.3. *Humidity.*—Mean dew point, 41.6; mean force of vapor, 0.426; mean relative humidity, 79.8. *Precipitation.*—Total rainfall or melted snow, 54.25 in.; number of days on which 0.01 in. or more rain or melted snow fell, 135; total snowfall, 69.5 in. *Weather.*—Mean cloudiness observed, 60 per cent; total cloudiness recorded by sun thermometer, 2,317 hours, or 52 per cent; number of clear days, 78; number of fair days, 138; number of cloudy days, 149. *Wind.*—Prevailing direction, W. or S. 86° W.; total movement, 48,425 miles; maximum daily movement, 675 miles, November 27; minimum daily movement, 4 miles, January 18; mean daily movement, 133 miles; mean hourly velocity, 5.5 miles; maximum pressure per square foot, 30.5 miles, 78 miles per hour, September 7. *Dates of frosts.*—Last, April 27; first, September 21. *Dates of snow.*—Last, April 6; first, November 24.

Meteorological observations (*Maine Sta. Rpt. 1897, pp. 201, 202*).—This is a monthly summary of observations during 1897 on atmospheric pressure, temperature, precipitation, cloudiness, and wind movement. The mean pressure for the year was 29.84 in.; the mean temperature, 42.46°, the mean for 29 years being 42.34°; precipitation, 39.99 in. (average for 29 years 45.2); snowfall, 58 in. (mean for 29 years 92.4); number of clear days, 125; number of cloudy days, 137.

Meteorological observations, W. T. ELLIS ET AL (*Canada Expt. Farms Rpt. 1897, pp. 60, 273, 356, 357, 434*).—Brief summaries of observations and general notes on the weather at the Central Experimental Farm and the experimental farms for the Maritime Provinces, Manitoba, the Northwest Territories, and British Columbia.

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[1] Reduced to freezing and sea level. The instruments are 2,735 ft. above sea level.

[2] Temperature in ground shelter 51 ft. below level of other instruments.

Report of the Chief of the Weather Bureau for 1898, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau Doc. 181, pp. 30*).—This is a summary account of the operations of the Weather Bureau during the fiscal year ending June 30, 1898, with an appendix by E. B. Garriott on the storms, cold waves, and floods of the year.

Monthly bulletins of the River and Flood Service, E. B. GARRIOTT (*U. S. Dept. Agr., Weather Bureau Doc. 173, pp. 13, chart 1; 175, pp. 15, chart 1; 177, pp. 15, chart 1*).—These bulletins give the usual summaries of observations on river stages and the condition of navigation during the months of July, August, and September.

The probable state of the sky along the path of total eclipse of the sun, May 28, 1900, F. H. BIGELOW (*U. S. Dept. Agr., Weather Bureau Doc. 179, pp. 6, chart 1*).—This is a second report[1] from observations made in 1898, reprinted from *Monthly Weather Review, 26 (1898), No. 9, p. 404*.

Phenological investigations in Schleswig-Holstein in 1897, P. KNUTH (*Schr. Naturw. Ver. Schleswig-Holstein, 11 (1898), No. 2, pp. 252–259*).

The influence of land and sea winds on the nitrogen content of rain, L. ANDERLAND (*Landw. Vers. Stat., 51 (1898), No. 1–2, pp. 159, 160*).—This is a brief review of a report of observations made at Tuy in Galicia (Spain),[2] showing that rains brought by winds from the ocean contain less ammonia than those coming from the direction of the land. The author urges stations favorably located for such work to make further observations on this point and also on the influence of manufacturing industries upon the nitrogen content of rain.

Climatology in Belgium, F. DE COURRNELLES (*Jour. Hyg., 23 (1898), No. 1153, pp. 505–508*).

The cyclone at Swabia, July 14, 1894, F. HORN (*Forstl. Naturw. Ztschr., 7 (1898), No. 12, pp. 429–438, figs. 4*).—A discussion of the causes and characteristics of this storm.

Cultural conditions of Tunis, DYBOWSKI (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 2, pp. 133–135; Rev. Sci. [Paris], 4. ser., 11 (1899), No. 3, p. 85*).—A discussion of the climatic conditions in this country, confined largely to the amount and distribution of rainfall.

Aneroid barometers, C. F. MARVIN (*U. S. Dept. Agr., Weather Bureau Doc. 180, pp. 6*).—The unreliability of aneroid barometers and the results of experiments on such barometers by C. Chree at Kew[3] observatory are briefly discussed.[4]

WATER—SOILS.

Analysis of Malmesbury soils, C. F. JURITZ (*Agr. Jour. Cape of Good Hope, 13 (1898), No. 13, pp. 818–822*).—In the Malmesbury district and in other portions of South Africa, there are soil areas which contain numerous slight elevations, from 1 to 4 ft. in height and 20 or more yards in diameter. The soil on these hillocks is alleged to be extremely rich, and cereals of all kinds are said to grow on them with luxuriance, while on the lower ground between the elevations the soil is poor and produces scanty crops. Analyses of samples of soil from

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[1] For first report see U. S. Dept. Agr., Weather Bureau Doc. 112; Monthly Weather Review, 25 (1897), No. 9, p. 394.

[2] Report from Observatorio meteorológico del colegio de la compania de Jesús en Guardia. Tuy, 1894, pp. 62.

[3] Phil. Trans. Roy. Soc. [London], ser. A, 195 (1895).

[4] See also U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 26 (1898), No. 9, p. 410.

these hillocks and from the adjacent level land gave the following average results:

Composition of hillock and level soil in South Africa.

	Lime.	Potash.	Phosphoric acid.
	Per cent.	*Per cent.*	*Per cent.*
Hillock soil	0.078	0.073	0.051
Level soil	.010	.061	.032

It will be seen from the table that each of the three constituents is less abundant in the level soil than in the hillock soil, the lime being especially deficient.

Canadian soils, F. T. SHUTT (*Canada Expt. Farms Rpt. 1897, pp. 151–170*).—The results are presented of chemical and partial mechanical analyses (1) of soils sent by farmers for examination, including 2 samples from British Columbia, 5 (1 of muck soil) from Ontario, and 4 from Quebec; and (2) of virgin soils,[1] including 29 samples (with subsoils) from British Columbia, 8 from the Northwest Territories and Manitoba, 9 from Ontario, 10 from Quebec, and 5 from the Maritime Provinces—New Brunswick, Nova Scotia, and Prince Edward Island. The samples and the regions from which they were obtained are briefly described, and the value of soil analysis, standards of fertility, and methods of analysis are discussed.

"The solvent used in the determination of total or maximum percentages of the mineral constituents has been hydrochloric acid, sp. gr. 1.115 (corresponding to 22.86 per cent HCl.), 10 gm. of the air-dried soil being digested with 100 cc. of the acid at the temperature of the water bath for 10 hours.

"For the estimation of the available potash and phosphoric acid 1 per cent citric acid solution has been employed, digesting 100 gm. of air-dried soil with 500 cc. of the solvent for 5 hours at room temperature."

The latter determinations were made in 1 soil only. The average composition of the surface soils examined is given in the following table:

Average analyses of virgin surface soils of Canada.

Number of samples.	Province.	Potash.	Phosphoric acid.	Nitrogen.	Lime.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
21	British Columbia	0.42	0.27	0.262	1.17
7	Northwest Territories and Manitoba	.44	.19	.537	1.08
6	Ontario (Muskoka only)	.22	.15	.135	.44
6	Quebec	.44	.20	.226	.52
5	Maritime Provinces	.44	.11	.130	.11
45	Average of all	39	.18	.258	.66

Although the above are averages of analyses of samples which "are typical, and, as far as possible, thoroughly representative of large areas,

[1] For previous work on such soils see Canada Expt. Farms Rpt. 1896, p. 184 (E. S. R., 9, p. 821).

taken from the thousands of square miles of uncultivated soil in the Dominion, they do not afford sufficient basis for generalizations regarding the average soil fertility of the yet untilled areas of the respective provinces."

"Our data indicate that good agricultural soils in Canada possess usually between 0.25 per cent and 0.5 per cent potash; less than 0.15 per cent in our experience, points to the necessity, or at all events to the value of potassic fertilizers, though with good climatic and soil conditions the limit might be reduced to that suggested by Hilgard.

"The phosphoric acid in Canadian virgin soils of average fertility lies usually between 0.15 and 0.25 per cent. Some good soils contain from 0.25 to 0.3 per cent, and a few exceed the latter figure. The adequacy or otherwise of phosphoric acid in a soil would appear to depend largely on the accompanying amount of lime. Increased crop production has usually followed the application of phosphatic fertilizers to soils containing less than 0.15 per cent phosphoric acid.

"Lime ranks next in importance to potash and phosphoric acid in a consideration of the mineral constituents of plant food. Our experience goes to show that clay soils, containing less than 0.5 per cent will have their productiveness increased by a dressing of lime in one or other of its agricultural forms. Peaty soils and soils generally that are rich in organic matter, are frequently poor in this element. All such have been found to respond to an application of lime, and more particularly so when given in conjunction with potash and phosphoric acid. For these classes of soils, therefore, I deem it advantageous that they should contain at least 1 per cent of lime.

"Richness in nitrogen may be measured to a large degree by the organic or humus content, though the condition or stage of decomposition of this organic matter is an important factor in determining the nitrogen's availability. The larger number of our good soils contain between 0.1 and 0.2 per cent, though many reach 0.5 per cent and some exceed 1 per cent nitrogen."

Some investigations on the nitrogenous matter of the soil, A. PAGNOUL (*Ann. Sci. Agron., 1898, II, No. 1, pp. 97–112*).—Previous work by the author is briefly summarized, and an account is given of 6 series of pot experiments carried out during 1897. The general plan of these experiments was as follows: Nitrogen in 3 forms—nitric, nitrous, and ammoniacal—was determined in the soil at the beginning of the experiment (200 gm. lots being used), various nitrogenous materials were added, and at intervals during periods of from 80 to 118 days determinations of nitrogen in the above forms were again made.

In the first series a comparison was made between the changes which the organic nitrogen of the soil and that introduced in the form of dried blood and manure undergoes. In these experiments 7.4 per cent of the original nitrogen in the soil, 59 per cent of the nitrogen of the dried blood, and 48 per cent of the nitrogen of the manure was rendered soluble in 80 days, due principally to nitrification. Over 50 per cent of the nitrogen of the dried blood became soluble in 12 days.

In the second series of experiments the assimilability of nitrogen in ground meat, peanut cake, and sesame cake was compared. Sixty-two per cent of the nitrogen in the meat powder was rendered soluble in 13 days, 100 per cent in 116 days; 64 per cent of the nitrogen of the peanut cake became soluble in 13 days, 100 per cent in 116 days; and 62

per cent of the nitrogen of the sesame cake was rendered soluble in 13 days, 94 per cent in 116 days.

In the third series of experiments castor-bean cake, colza cake, and wool waste (dust) were compared. In case of the first 52 per cent of the nitrogen was rendered soluble in 11 days, 80 per cent in 107 days; in the second case 32 and 70 per cent, respectively; and in the third case 6 and 46 per cent, respectively.

In the fourth series of experiments the effect of previously heating the soil to 100° and adding a small amount of sulphuric acid was tested. In this series 2 pots received dried blood without previous treatment of the soil, 1 received dried blood after the soil had been heated to 100°, and another received dried blood after heating to 100° and adding a small amount of acid. The heating had the effect of reducing the nitric nitrogen and increasing the amount of ammoniacal and nitrous nitrogen produced. Heating to 100° C., especially with the addition of acid, appears to have been destructive to the nitrifying organisms.

In the fifth series of experiments an investigation was made of the progress of nitrification in soils to which mixtures of horse manure and nitrate of potash or sulphate of ammonia with or without starch were added. The results indicate that horse manure, especially in the presence of starch, tends to cause the disappearance of nitrates, but under the conditions of these experiments, *i. e.*, with a temperature of 30° and a sufficient supply of air and moisture, this disappearance of nitrogen is not due to an evolution of free nitrogen but largely to the formation of new organic compounds of nitrogen.

In the sixth series of experiments a comparison was made of the transformations of nitrogen which go on in soil very rich in humus and nitrogen, with and without the addition of nitric and ammoniacal nitrogen. The transformations of nitrogen were somewhat slower in this case than in the case of an ordinary soil.

On the composition of natural humus substances, G. ANDRÉ (*Compt. Rend. Acad. Sci. Paris*, *127* (*1898*), *No. 11*, *pp. 414–417; abs. in Ann. Agron.*, *24* (*1898*), *No. 12*, *pp. 602–604*).—In the investigations here reported vegetable mold, moor soil, compost, and peat were treated with (1) potash followed by hydrochloric acid and (2) hydrochloric acid followed by potash. The ammonia volatilized and the nitrogen soluble and insoluble in the acid and alkali were determined. The results reported show the complex character of the nitrogenous matter of the soil. Previous work by Berthelot and André[1] led to the conclusion that the nitrogenous matter of the soil is of an amid character.

The lime content of soils and nitrification, F. POLZENIUSZ (*Ztschr. Landw. Versuchw. Oesterr.*, *1* (*1898*), *p. 235; abs. in Centbl. Agr. Chem.*, *28* (*1899*), *No. 1*, *pp. 12*, *13*).—Samples of 200 gm. each of a soil containing 0.546 per cent of lime, 0.014 per cent of which was carbonate, were placed in glass dishes, and in different cases 0.0866 gm. of nitrogen in

[1] Ann. Chim. et Phys., 6. ser., 11 (1887), p. 368; 25 (1892), p. 314.

the form of bone meal and of sulphate of ammonia were added. In one series of experiments no lime was added; in the other series 3 gm. carbonate of lime were added in each case. The soils were kept moist, and the carbon dioxid which passed off was measured. After several weeks the samples were extracted with water, and ammonia and nitric nitrogen were determined in the solution. The soils were also extracted with dilute hydrochloric acid and the ammonia determined. The results show that the soil originally contained sufficient lime for the nitrification of the bone-meal nitrogen, but that the addition of lime was necessary for the transformation of the ammonium sulphate. In case of the soil to which no lime was added only 0.19 per cent of the nitrogen added in form of ammonium sulphate was nitrified, while in the experiments with lime 76 per cent of this nitrogen was transformed. The author concludes that the good results obtained in this case are due to the neutralization of the sulphuric acid of the sulphate of ammonia by the calcium carbonate, and that this result can not be accomplished as effectively by any other form of lime.

The effect of carbon bisulphid on the fertility of soils, E. WOLLNY (*Vrtljschr. Bayer. Landw. Rath., 1898, No. 3, pp. 319–342*).—The results of a series of experiments are recorded in which the effect of carbon bisulphid on the fertility of the soil was studied. Pot and plat experiments were made with various crops and fertilizers and the carbon bisulphid was applied at different times. The author concludes that treating the soil with carbon bisulphid during the vegetative period of the crop is detrimental to the plants, but if the soil is treated several months before the crop is planted its fertility is increased to a noticeable degree, and the effect is noticeable in the growth of several succeeding crops. An explanation of this action of the carbon bisulphid on the fertility of the soil is not given. It was found that activity of the nitrifying organisms and the root-nodule bacteria of legumes is temporarily retarded by the carbon bisulphid treatment, but that eventually their activity again becomes normal.

Well water from farm homesteads, F. T. SHUTT (*Canada Expt. Farms Rpt. 1897, pp. 180–185*).—The results are given of analyses with reference to sanitary condition of 66 samples of well water; "one from British Columbia, 6 from the Northwest Territories, 28 from Ontario, 8 from Quebec, 7 from New Brunswick, and 17 from Prince Edward Island. Of these, 50 per cent were reported dangerously polluted and unsafe for drinking purposes, 25 per cent as suspicious and in all probability as unsafe, and 25 per cent as unpolluted and wholesome."

Soil analysis, its historical development and its significance to agriculture, A. OTTO (*Fühling's Landw. Ztg., 47 (1898), No. 23, p. 892*).—A general discussion.

The calcareous efflorescence found on cultivated soils, F. SESTINI (*Atti. R. Accad. Econ. Agr. Georg. Firenze, 21 (1898), No. 2, pp. 14, pl. 1*).—The analyses showed the samples of this substance examined to be essentially carbonate of calcium and magnesium with a small amount of carbonate of ammonia.

The judging of the physical properties of soils by means of the heat which they evolve when moistened, A. MITSCHERLICH (*Beurtheilung der physikalischen Eigenschaften des Ackerbodens mit Hilfe seiner Benetzungswärme. Inaug. Diss., Kiel, 1898, pp. 52, pls. 2*).—See E. S. R., 10, p. 123.

On the influence of frost on cultivated soils, E. WOLLNY (*Fühling's Landw. Ztg., 47 (1898), No. 17, pp. 631–636; 18, pp. 675–681; 19, pp. 709–714; 20, pp. 749–756*).—A general discussion of this subject based largely upon the author's extended studies.

Is a lack of lime general in Rhode Island soils? H. J. WHEELER and G. E. ADAMS (*Rhode Island Sta. Bul. 49, pp. 37–48*).—This is a brief summary of experiments with lime during a number of years on a variety of crops and at different points in Rhode Island. The results indicate the wide distribution in the State of soils which are benefited by applications of lime. It was found that beets "furnish an unusually good crop for testing soils as to their lime requirements."

Comparative trials of lime worked into the soil before seeding and applied as a top-dressing afterwards, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 49, pp. 48–50*).—From the results of experiments made at the station on timothy "it seems that the recommendation to lime land before seeding is one that should be adhered to if the best results are to be obtained."

FERTILIZERS.

The fertilizing value of street sweepings, E. E. EWELL (*U. S. Dept. Agr., Division of Chemistry Bul. 55, pp. 19*).—This bulletin summarizes data regarding disposal of street sweepings in 204 out of the 354 cities and towns of the United States having 10,000 or more inhabitants, as furnished by replies to circulars of inquiry sent to officials in charge of street-cleaning departments. "The total quantity of street sweepings annually collected may be estimated at not far from 3,000,000 tons. . . . In general terms it may be stated that the cities representing one-fourth of the urban population of the country make an effort to utilize the fertilizing value of some portion of their street sweepings."

Analyses of 18 samples of sweepings collected in Washington, D. C., are reported. In these the nitrogen varied from 0.17 to 1.18 per cent, phosphoric acid from 0.01 to 0.16 per cent, and potash from 0.09 to 0.5 per cent. Extracts from letters from farmers and gardeners who have used street sweepings are quoted to show "that well-selected and judiciously used street sweepings possess considerable manurial value."

Valuing nitrogen at 10 cts. per pound and disregarding phosphoric acid and potash, the poorest sample of sweepings examined would be worth 34 cts. per ton; the richest, $1.46.

Contribution to the study of street dust as a fertilizer, A. CASALI (*Contributo allo studio pratico della polvere di strada come materia ammendante e concimante, Bologna, Societa Tipografica gia Compositori, 1899, pp. 23; Staz. Sper. Agr. Ital., 31 (1898), pp. 377–396; abs. in Chem. Centbl., 1898, II, No. 22, p. 1106*).—This article discusses the formation, composition, properties, fermentation, and uses of street dust, and reports results of analyses of a few samples. The composition of the substance examined was as follows: Moisture 1.20, nitrogen 0.05 (traces in form of ammonia and nitric acid), potash 0.16, lime 22.34, phosphoric acid 0.09, carbon dioxid 17.33, and silica 46.44 per cent. Of the material, 15.9 per cent was soluble in 5 per cent acetic acid, 30 per cent in 25 per cent hydrochloric acid, and 0.4 per cent in boiling water. It lost 33.5 per cent on calcination.

The author concludes from his study that one of the most marked and important properties of this material is its power of inducing beneficial fermentations in manure and in the soil.

Seaweed as manure, J. HENDRICK (*Agr. Students' Gaz., n. ser., 9 (1898), No. 2, pp. 41–49*).—The author reports analyses and discusses the fertilizing value of 3 samples of cut weed, or shore weed, including 2 of *Fucus nodosus* and 1 of *F. vesiculosus*; 1 sample of *F. ceranoides*, which grows in brackish or almost fresh water, and 3 samples of drift weed, including 1 of mixed seaweed, 2 of *Laminaria digitata* (stalk and blade), 1 of *L. saccharina*, and 1 of *Alaria esculenta*. The author concludes that, weight for weight, seaweed is about equal in value to barnyard manure, but differs from the latter in its higher content of potash and lower content of phosphoric acid. It is also claimed that seaweed must undergo decay before its nitrogen (rarely less than 0.5 per cent) is available for plants or even ready for nitrification. The potash in seaweed is in a very available form. If fresh living seaweed is placed in fresh water "a large part of its potash will diffuse out into the water as soluble potash salts, chiefly chlorid, in a few hours."

The black phosphates of the Pyrenees, D. LEVAT (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 21, pp. 834–836; abs. in Rev. Sci. [Paris], 4. ser., 10 (1898), No. 23, p. 726*).—Extensive deposits of a phosphate having the appearance of anthracite have recently been discovered in the Pyrenees. This deposit lies between strata of marble or limestone and schist. The richer portion of the deposit contains numerous hard brilliant black nodules which contain from 65 to 75 per cent of tricalcium phosphate. The gangue surrounding the nodules is also phosphatic. The phosphate contains a considerable amount of organic matter yielding from 3 to 5 kg. of organic nitrogen per ton. The bed is from 8 to 10 meters thick.

Report of analyses of commercial fertilizers for the spring of 1898, L. L. VAN SLYKE (*New York State Sta. Bul. 145, pp. 49–149*).—This bulletin contains notes on the valuation of fertilizers, suggestions regarding purchase of fertilizing materials, a list of manufacturers complying with the requirements of the State fertilizer law, an explanation of terms used in stating results of analyses, and tabulated analyses of 1,183 samples of commercial fertilizers, representing 739 different brands collected by the station during the spring of 1898. Of the 739 brands examined 578 were complete fertilizers. "Of the others 55 contained phosphoric acid and potash without nitrogen, 47 contained nitrogen and phosphoric acid without potash, 8 contained nitrogen only, 44 contained phosphoric acid alone, and 7 contained potash salts only." In the complete fertilizers the nitrogen varied from 0.12 to 8.21 per cent, averaging 2.2 per cent. The available phosphoric acid varied from 3.69 to 14.28 per cent, averaging 8.65 per cent. The potash varied from 0.22 to 15.22 per cent, averaging 4.91 per cent. The average amounts of nitrogen, available phosphoric acid, and potash exceeded the guaranteed average by 0.14, 1, and 0.24 per cent, respectively.

In 110 cases the potash in the complete fertilizers was in the form of sulphate free from an excess of chlorids.

"The retail selling price of the complete fertilizers varied from \$15 to \$45 a ton and averaged \$27.65. The retail cost of the separate ingredients unmixed averaged \$18.52 or \$9.13 less than the selling price."

On the occurrence of perchlorate in nitrate of soda and its injurious effect upon the growth of cereals and sugar beets, A. ZAHARIA (*Bul. Soc. Sci. Bucharest, 7, pp. 361–405: abs. in Chem. Centbl., 1898, II, No. 22, p. 1106*).—The author gives a very complete review of the literature of this subject and reports the results of 3 series of his own experiments on the action of perchlorate on the germination and growth of the more important agricultural plants. Experiments were conducted both in the field and in vegetation pots.

As a rule the germinative power of cereals sustained little or no injury from the perchlorate, although in case of barley and oats treated with concentrated solutions the development of the plantlet was retarded. In case of beet seed, on the other hand, neither the germinative power nor the growth of the plantlet was seriously interfered with by the perchlorate solutions. It was found in general that nitrate of soda containing 1.5 per cent of perchlorate had no injurious effect upon wheat and barley. Small amounts of perchlorate were apparently beneficial to beets. The growth of peas was retarded and the yield decreased by perchlorate.

Egyptian clay and salt, J. GOLDING (*Rpt. on Experiments, Agr. Dept. Univ. College, Nottingham, 1898, pp. 4*).—A brief account is given of experiments on permanent meadow, barley, oats, and wheat with a crude salt obtained by lixiviation of the nitrate-bearing clays which occur in upper Egypt (E. S. R., 6, p. 516). The sample of salt used in these experiments contained about 56 per cent of sodium nitrate, 31 per cent sodium chlorid, and 9.5 per cent of sodium sulphate. The results of the experiments indicate that the salt is "worth quite as much per unit of nitrogen as nitrate of soda imported from Chile, also that dressings of 1½ cwt. per acre are likely to produce good results, especially on barley and pasture grass."

On the fertilizing value of the nitrogen of fresh and old barnyard manure, M. MAERCKER (*Agr. Chem. Vers. Stat. Halle, 2 (1898), p. 51*).

On green manuring, RÜMKER (*Ueber Gründüngung. Schönberg-Berlin: F. Telge, 1898, pp. 48*).—This little pamphlet discusses the general principles of green manuring and their application in the management of light and heavy soils. A brief bibliography of the subject is appended.

Notes upon garbage fertilizers, W. FREAR (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 524–529*).—Analyses of crematory ashes and garbage tankage, alone or mixed with phosphates and sulphuric acid, are reported, and the fertilizing value of these substances is discussed.

Fertilizers in the village, H. FAYET (*Les engrais au village. Paris: Librairie Larousse, 4. ed., pp. 8+200*).—An elementary general treatise on fertilizers, designed for small farmers in France.

Naturally-occurring fertilizers, F. T. SHUTT (*Canada Expt. Farms Rpt. 1897, pp. 170–179*).—Analyses, with notes on use as fertilizers, of 9 samples of swamp muck; 6

samples of marsh, creek, and tidal deposits; 1 sample of marl; 2 samples of lobster refuse (bodies and tails); 1 of limekiln ashes; 1 of purslane; 1 of a fraudulent mixture "for making manure," and 2 of moss litter.

On the fertilizing value of olive cake (*L'Engrais, 14 (1899), No. 7, p. 159*).—Analyses are given which show 0.75 to 0.77 per cent of nitrogen, 0.17 to 0.20 per cent of phosphoric acid, and 0.43 to 0.45 per cent of potash.

Inspections for 1897, C. D. WOODS (*Maine Sta. Rpt. 1897, pp. 52–60*).—This is a brief summary of the work done during the year in the inspection of fertilizers and feeding stuffs, with brief reference to the testing of seeds and of chemical glassware used in creameries.

The fertilizer law of South Australia, W. L. SUMMERS (*Jour. Agr. and Ind., South Australia, 2 (1899), No. 6, pp. 499, 500*).—An abstract.

Tabulated analyses of commercial fertilizers, T. J. EDGE and W. FREAR (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 797–836*).—A reprint of Bul. 33, Pennsylvania Dept. Agr. (E. S. R., 9, pp. 825).

Fertilizer experiments with steamed bone meal, B. SCHULZE (*Jahrb. Agr. Chem. Vers. Stat. Breslau, 1896; abs. in Centbl. Agr. Chem., 28 (1899), No. 2, pp. 81–85*).—From the results of experiments with winter wheat, potatoes, and sugar beets on loamy and clayey soils rich in humus the author concludes that bone meal is about as effective as superphosphate.

Is intensive manuring profitable at present prices for crops? P. WAGNER (*Ztschr. Landw. Ver. Hessen, 1898, No. 14, p. 125; abs. in Centbl. Agr. Chem., 28 (1899), No. 2, pp. 85–89*).—The results of numerous experiments are cited to show that under the conditions of these experiments this question should be answered in the affirmative.

FIELD CROPS.

Experiments with field crops, W. SAUNDERS (*Canada Expt. Farms Rpt. 1897, pp. 5–60, fig. 1, pls. 2*).—The experiments in 1897 consisted of variety, fertilizer, and culture tests with field and forage crops. The results of vitality tests of grain and other seeds, and the amount of seed distributed in 1897 are reported in tables. The average results of the variety tests obtained on all the experimental farms has been previously reported (E. S. R., 9, p. 826).

Experiments were begun to ascertain the value of rolling and harrowing land sown with clover, and of sowing different quantities of clover per acre with barley. Harrowing only after sowing without rolling gave the best yield. However, the plat not rolled or harrowed after sowing yielded but 1 bu. per acre less. The experiments showed that clover can be grown with grain without lessening the yield. About 10 lbs. of clover seed per acre was used in most cases. The largest weight of clover leaves, stems, and roots, 8 tons 505 lbs. per acre, was produced on 2 plats, one sown with oats and 10 lbs. of mammoth red clover per acre, and the other with barley and 10 lbs. of common red clover per acre. The weight was determined on October 20.

Horse beans, soy beans, sunflowers, buckwheat, flax, and awnless brome grass were grown experimentally. Short notes on each crop and the yields produced are given. The results of fertilizer experiments carried on for a number of years with 19 applications of various fertilizers, used singly and in different combinations, are reported in tables. The crops grown in connection with these tests were wheat, barley,

oats, corn, mangel-wurzels, turnips, and potatoes. In general, the application of 15 tons of fresh barnyard manure per acre gave the best results.

Farm crops at the experimental farm at Brandon, Manitoba, S. A. BEDFORD (*Canada Expt. Farms Rpt. 1897, pp. 307-328*).—The experiments reported included variety tests of wheat, oats, barley, peas, corn, turnips, mangel-wurzels, carrots, sugar beets, potatoes, millets, clovers, and grasses, and trials of early, medium, and late sowings of wheat, oats, barley, and peas. All results are given in tables.

Wheat, after a summer fallow, produced a better yield and heavier grain than wheat grown on spring-plowed or fall-plowed land. A test of preparing unplowed stubble land for wheat showed that disking the land after burning the stubble and then drilling in the seed gave better results than drilling the seed on burned or unburned stubble, or on disked unburned stubble land. Very smutty Red Fife wheat treated with a bluestone solution at the rate of 1 lb. bluestone to 10 bu. of wheat yielded 20 bu. 10 lbs. per acre, the grain weighing 59 lbs. per bushel, and the same seed sown untreated yielded 8 bu. 40 lbs. per acre, the grain weighing 46 lbs. per bushel.

Among the 10 grasses tested western rye grass (*Agropyrum tenerum*) and awnless brome grass (*Bromus inermis*) were the most productive. In most cases sowing the seed at the rate of 15 lbs. per acre gave the best results.

Farm crops at the experimental farm at Indian Head, Northwest Territories, A. MACKAY (*Canada Expt. Farms Rpt. 1897, pp. 357-379*).—Variety tests were made with spring wheat, barley, oats, peas, corn, millets, grasses, root crops, and potatoes. Tests of early, medium, and late sowings and of sowing different quantities of seed per acre are reported. Canary grass, buckwheat, tares, and spring rye were grown experimentally. All results are given in tables.

Wheat sown 1 and 2 in. deep gave a much better yield than wheat sown 3 in. deep. The average results for the past 6 years were in favor of sowing 1 in. deep and at the rate of $1\frac{1}{4}$ bu. per acre. This season wheat sown with a press drill gave better results than wheat sown with a hoe drill, which accords with the average results of 6 years' tests. A larger yield of wheat was produced on fallow than on fall plowed land or spring plowed and unplowed stubble land.

In a test of mixed grain for fodder, barley and oats sown at the rate of 1 bu. each per acre produced the heaviest yield.

Flax sown May 25 at the rate of 40 lbs. per acre gave a larger yield of seed than flax sown on other dates or at different rates. The largest amount of straw per acre was obtained from a sowing made the same day at the rate of 80 lbs. of seed per acre.

An observation upon the after effect upon the growth of barley of the roots of the flat pea (Lathyrus sylvestris), H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 49, pp.*

51–53, figs. 2).—During 1898 barley was grown on 2 plats, one of which had previously been in carrots and the other in flat peas. The plat on which carrots had been grown had received 87 lbs. per acre more of nitrate of soda, 50 lbs. more of muriate of potash, and a larger amount of available phosphoric acid than the one devoted to flat peas. During 1897 the flat peas were cut twice, yielding 7,650 lbs. per acre of hay. In 1898 the two plats were prepared and fertilized in exactly the same way and seeded to barley. The growth of barley was more vigorous and the yield much greater on the plat which had previously been in flat peas than on that which had borne carrots and received more liberal fertilizing.

Experiments with crimson clover and hairy vetch, J. F. DUGGAR (*Alabama College Sta. Bul. 96, pp. 183–208, figs. 5*).—This bulletin reports the results of inoculation experiments with crimson clover and hairy vetch, and gives a general discussion on soil improving plants, the significance of root tubercles, and the inoculation of soil or seed. Brief notes regarding crimson clover and hairy vetch are given. Natural methods of inoculation and the cause for the frequent failure of Nitragin are pointed out.

Four twentieth-acre plats were used for an inoculation experiment with crimson clover. The soil was a clay loam and in a low state of fertility, and so far as known clover had never been grown on these plats nor in adjoining fields. All plats were fertilized alike, and the seed was sown on November 5 at the rate of 1 pt. per plat. No nitrogenous fertilizer was applied. Plats 1 and 3 were sown with inoculated seed, and plats 2 and 4 were sown in the usual way. The seed was inoculated by moistening it with water to which about 2 teaspoonfuls of clover Nitragin had been added. The average yield of the inoculated plats was 14,039 lbs. of green forage per acre, and of the uninoculated plats 2,293 lbs. per acre; the yield as cured hay was 4,057 lbs. and 761 lbs. per acre, respectively. Plats 2 and 4 were in part inoculated accidentally, so that the results failed to do full justice to the increase effected by inoculation.

In one experiment 2 lots of hairy vetch seed were sown, one of which was dipped into water into which had been stirred earth from a spot where vetch had grown for several years in succession. The plants from the inoculated seed made the best growth and yielded at the rate of 2,545 lbs. of cured hay per acre, while uninoculated seed yielded only 232 lbs. The inoculated plants had large clusters of tubercles on the roots, while the others had no tubercles.

In a similar experiment the seed for some plats was inoculated with vetch Nitragin. The results were similar to those obtained from seed inoculated with vetch earth. In this case the increase in yield of hay per acre as a result of inoculation was 2,706 lbs. Earth from a field of lespedeza used as inoculating material for crimson clover had no effect. It is stated that with few exceptions the inoculation of a leguminous plant can be affected only by the root-nodule bacteria from a plant

belonging to the same genus. An exception noted is the ability of the root-nodule bacteria of the garden pea to inoculate the vetch.

Rye cut when nearly mature yielded about 200 lbs. of hay per acre more than uninoculated hairy vetch grown under the same conditions.

The averages of several determinations of nitrogen in inoculated and uninoculated plants are given in the following table:

Nitrogen in inoculated and uninoculated plants.

	Nitrogen content.		Nitrogen per acre.		
	Tops.	Roots and stubble.	Tops.	Roots and stubble.	Total product.
	Per cent.	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*
Rye, nearly mature	0.52	0.35	16.9	9.1	26.0
Hairy vetch, uninoculated	1.23	1.19	2.4	4.6	7.0
Hairy vetch, inoculated	2.71	1.37	85.6	19.9	105.5
Crimson clover, uninoculated	1.62	.97	1.7	2.6	4.3
Crimson clover, inoculated	2.48	1.63	1.2	23.7	143.7

Fertilizer experiments with inoculated hairy vetch, using mixtures of acid phosphate and muriate of potash, as compared with no fertilizer, showed considerable increase with the potash and phosphoric acid.

"Leguminous plants . . . when amply supplied with tubercles need no nitrogenous fertilizers, but are highly responsive to acid phosphate and potash salts. These plants make heavy demands on the mineral plant food of the soil."

Grasses and forage plants, B. C. PITTUCK (*Texas Sta. Bul. 46, pp. 1011–1030, figs. 11*).—This bulletin gives brief statements concerning the relative value of 47 species of grasses and 14 other hay and forage plants, grown in an experimental way at the station. In describing the results of the tests of sorghum and teosinte the conclusions given in a former bulletin are repeated (E. S. R., 2, p. 742).

Experiments on the influence of depth of plowing on the rate of seeding resulted in the best yields from broadcasting sorghum at the rate of 4 bu. per acre on land plowed 15 in. deep and broadcasting at the rate of 2 bu. per acre on land plowed 5 in. deep. Sorghum drilled in rows 3 ft. 8 in. apart at the rates of $\frac{1}{2}$ and 1 bu. per acre gave best returns on land plowed 5 in. deep, while drilling in rows 3 ft. apart at the rate of 1 bu. per acre gave best results on land plowed 15 in. deep.

Report of the State chemical-control station at Christiania, Norway, for 1897, F. H. WERENSKIOLD (*Christiania, 1898, pp. 60*).—The report gives an account of the activities of the station during the year, and contains summary statements and general discussions of the results obtained. The investigations here referred to have been continued from preceding years (E. S. R., 9, p. 398).

Over 300 samples of sugar beets were analyzed during the year. The samples contained from 8.47 to 14.98 per cent of sugar in the beet, the average of all analyses being 12.64 per cent. The yields obtained were small and in but few cases reached 12 tons per acre. For this reason the results of the investigation are not considered very reliable.

The results of analyses of 141 samples of root crops other than sugar beets are shown in the following table:

Composition and yield of root crops in 1897.

	Carrots (20 samples).		Kohl-rabi (26 samples).		Yellow turnips (40 samples).	
	Range.	Average.	Range.	Average.	Range.	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Water	85.02–89.59	88.15	86.27–91.20	88.41	88.75–92.31	90.95
Protein	.72–1.24	.97	.92–1.89	1.29	.75–1.61	1.01
Fat	.14–.35	.25	.10–.32	.17	.04–.28	.14
Crude fiber	.96–1.22	1.10	1.01–1.35	1.14	.73–1.42	.94
Ash	.69–1.38	.92	.60–.97	.71	.49–1.07	.68
Sugar	4.38–8.34	5.87	4.95–7.65	6.18	4.02–5.66	4.68
Other components	1.81–5.68	3.00	1.09–3.37	2.24	.33–2.78	1.63
Yield per acre (pounds)	31,850		31,630		47,550	

	White turnips (13 samples).		Fodder beets (36 samples).	
	Range.	Average.	Range.	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	90.91–92.99	92.30	81.70–90.04	85.67
Protein	.64–.94	.81	.77–1.95	1.46
Fat	.07–.15	.11	.06–.25	.13
Crude fiber	.72–.87	.80	.67–1.97	1.03
Ash	.53–.68	.61	.78–1.21	.99
Sugar	3.52–4.61	4.18	5.06–11.17	8.02
Other components	.12–1.39	.99	.89–4.64	2.67
Yield per acre (pounds)	56,320		27,750	

—F. W. WOLL.

The culture of beets on the experimental field at Grignon in in 1895, 1896, and 1897, P. P. DEHÉRAIN (*Ann. Agron., 24 (1898), No. 2, pp. 49–83*).—The work here reported consisted of variety and fertilizer tests with fodder and sugar beets. The results for each year are discussed separately and the weather conditions for each season are described. The details of the experiment and the results are given in tables. In 1895 only a few varieties of beets were tested, but drought interfered with the experiment, and but little significance is given to the results obtained.

In 1896 4 varieties of beets, including the Vilmorin sugar beet, were grown on plats which had produced wheat the preceding year. On several of these plats the effect of inoculation with nitrified soil was studied and compared with nitrate of soda. The author states that the formation of nitrates due to the action of soil ferments is insufficient in the spring for the needs of the plant, which may perhaps be due to meteorological conditions or the possible failure of the nitric ferments to become active until a month or 6 weeks after vegetation has begun to grow. A fertile soil had been taken up in the fall and kept under conditions which favored nitrification in the winter. In the spring furrows were made with a hoe between the rows of beets and the nitrified soil scattered into them at the rate of 200 kg. per hectare and covered. It is stated that the amount of nitrates thus brought to the soil is too small to have much effect, and that the

benefit resulting from such a practice must be ascribed to the activity of the micro-organisms with which the soil is inoculated. In addition to nitrified soil or nitrate of soda, both applied at the rate of 200 kg. per hectare, a general application of 20,000 kg. of barnyard manure per hectare was given. The following table shows the results obtained:

Yield of beets on plats fertilized with nitrified soil and nitrate of soda in 1896.

Variety.	Kind of fertilizer used.	Yield per hectare.	Average weight per beet.	Dry matter per hectare.	Sugar per hectare.	Nitrogenous matter per hectare.	Nitrate of potash removed in the crop per hectare.
		Kg.	*Gm.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
Globes jaunes	Nitrate of soda	70,000	650	8,239	5,460	581.0	51.8
Do	Nitrified soil	53,800	500	6,483	4,250	433.7	46.8
Collets roses	Nitrate of soda	38,500	450	6,911	5,005	522.5	18.5
Do	Nitrified soil	42,300	470	7,701	5,499	505.6	28.0
Globes jaunes	Nitrate of soda	57,500	510	6,400	4,542	528.0	51.8
Do	Nitrified soil	53,600	470	6,925	5,092	450.0	52.5
Collets roses	Nitrate of soda	37,600	410	6,636	4,662	468.0	41.7
Do	Nitrified soil	48,500	390	8,594	5,529	633.7	50.4
Vilmorin improved	Nitrate of soda	28,300	330	6,345	4,500	435.0	8.5

In 1897 the work was continued along the same lines. Unlike the fall of 1896, the fall of 1897 was comparatively dry. The following table presents the difference in composition of the beets for the two seasons:

Comparison of the composition of beets grown in 1896 and 1897.

Variety.	Dry matter.		Sugar content.		Nitrogenous matter.		Nitrate of potash.	
	1896.	1897.	1896.	1897.	1896.	1897.	1896.	1897.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Collets roses	17.99	18.5	13.0	12.1	1.275	1.28	0.057	0.107
Globes jaunes	12.44	15.9	8.5	10.5	.850	1.30	.087	.237
Tankards	13.37	14.5	10.1	9.5	.812	.76		
Vilmorin	22.50	22.3	15.5	16.6	1.666	1.31	.045	.045

The Vilmorin sugar beet varied least in composition. The Tankards were found to contain a large percentage of nitrate of potash and are considered of little value on this account. This season nitrified soil was less effective than nitrate of soda for all varieties.

A comparison of varieties of sugar beets grown this season is shown in the following table:

Density of the juice and sugar content of different varieties of sugar beets.

Variety.	Density of the juice.	Sugar in the juice.	Sugar in the beet.
		Per cent.	*Per cent.*
Vilmorin	70.7	17.0	16.6
Wohanka No. 1	70.9	18.5	17.4
Wohanka No. 2	70.6	19.8	18.6
Mette M. V	70.9	17.9	16.8
Mette M. K. V	70.6	17.6	16.5
Mette M. S. P	80.2	18.6	17.4

The average sugar content of the beets was 18.2 per cent for plats fertilized with barnyard manure, 17.8 per cent for plats fertilized with barnyard manure and nitrified soil, and 17.1 per cent for the plats fertilized with barnyard manure and nitrate of soda.

Experiments with sugar beets in Norway in 1897, B. LARSEN (*Norsk. Landmansblad, 17 (1898), No. 7, pp. 77, 78; Tidsskr. Norske Landbr., 5 (1898), No. 2, pp. 80–89*).—This is a report on cooperative experiments with different kinds of sugar beets conducted under the direction of the agricultural experiment station at Aas, Norway. The experiments were made at 18 different farms. The average percentage of sugar in the beets obtained was 12.68 per cent and the average weight of beets was 358 gm. The beets grown at the Aas Experiment Station had an average sugar content of 13.19 per cent with a range from 12.7 to 13.5 per cent.—F. W. WOLL.

Experiments at the Derebchinskoe experiment field of Baron A. A. Mas, F. LYNBANSKI (*Kiev, 1897, Vol. IX, pp. 176; abs. in Selsk. Khoz. i Lyesov., 188 (1898), No. 2, pp. 471, 472*).—Experiments were made to determine the influence of depth of plowing, size of seed, and the use of commercial fertilizers on the yield and quality of sugar beets. It was found that by plowing the soil at depths varying from 7 to 10½ in., the yield increased with the depth of plowing, but that the sugar content suffered a loss. Beets grown from large seed gave better yields and were richer in sugar than beets grown from small seed. A liberal use of nitrogenous fertilizers increased the yield considerably but decreased the sugar content to some extent.

A test was made of nitrate of soda as a top-dressing for oats and barley. The result showed an increase in the yield of each crop and an increase in the phosphoric acid content of the barley.—P. FIREMAN.

Experiments with sugar beets at the experiment station of Count Bobrinski at Smyela, Kiev Government, Russia, V. BONDIRYEV (*Selsk. Khoz. i Lyesov., 184 (1897), pp. 165–176*).—Fertilizer experiments with sugar beets were made on a Chernozem soil, rich in nitrogen and containing over 0.02 per cent available phosphoric acid but comparatively poor in potash and lime. The fertilizers, lime, potash, nitrate of soda, and superphosphate, were applied on plats of 525 sq. ft. each. The lime refuse from sugar factories was used as the lime fertilizer.

The nitrogenous fertilizer showed a tendency to deform the beets but increased the size of those parts which are rejected at the factory, while the other forms of fertilizers had the opposite effect. The sugar content and purity of the juice was decreased by the use of the nitrogenous fertilizer and lime, but the yield of beets was increased to some extent. The potash and superphosphate improved the quality and increased the quantity of the crop. The greatest increase in sugar was due to the potash fertilizer.

The results of other experiments conducted show that plowing 14 in. deep for sugar beets was better than plowing 10½ in. deep.—P. FIREMAN.

Experiments on sugar beets in the Royal School of Agriculture at Portici (*Bol. Not. Agr., 19 (1897), I, No. 28*).—Experiments with sugar beets are described and the results tabulated and discussed. The use of commercial fertilizers increased the sugar content but not to a great extent, and this result is attributed to unfavorable weather conditions and to the fact that the fertilizers were not applied long enough before planting. The Vilmorin Improved sugar beet gave the best results among 4 varieties tested. The latter part of August was found to be the best time for harvesting beets.

Tobacco, J. CRAIG (*Canada Expt. Farms Rpt. 1897, pp. 131–133*).—The work consisted of culture and fertilizer tests, and experiments on the time of topping and the number of leaves to allow each plant. Tobacco plants transplanted into hot beds and cold frames before setting them out in the field gave yields so nearly alike that no conclusions are drawn. Among the different fertilizer experiments the largest yield of green leaf was obtained from an application of superphosphate, wood ashes, and nitrate of soda mixed in the proportion of 15, 15, and 5 lbs. respectively, and applied at the rate of 10 lbs. to 24 plants.

Plants were cut back to 9 and 11 leaves on July 20 and 26 and August 2. The larger yields were obtained from the later topping and the greater number of leaves.

Experiments with wheat, J. S. NEWMAN and C. M. CONNER (*South Carolina Sta. Bul. 37, pp. 1*).—Experiments with wheat, comprising variety tests and a comparison of broadcasting and drilling seed were conducted for 2 years. The wheat was sown in the fall. The results are given in tables and the 7 varieties tested are described. Red Winter gave the best yield in all tests—21 bu. per acre in the variety test and 30.2 and 25.2 bu. for the broadcasted and drilled plats respectively. Lancaster and Red May stood first among the varieties tested for 2 years, yielding on an average 15.1 and 12.3 bu. per acre respectively. On the drilled plats the grain came up more evenly than on the broadcasted plats.

Wheat (*Kentucky Sta. Bul. 77, pp. 109–120*).—The experiments reported consisted of variety and fertilizer tests of wheat. The meteorological conditions of the season and the results of the experiments are given in tables (E. S. R., 9, p. 639). Notes on all varieties and detailed descriptions of the varieties not described in former bulletins are given.

Twenty varieties were grown on twentieth-acre plats in drills 7 in. apart. The seed was sown at the rate of 1½ bu. per acre October 25. Jones Winter Fife, Early White Leader, American Bronze, and Bearded Winter Fife were the most productive, yielding 22.3, 19, 18.5, and 18.2 bu. per acre respectively. The weight per bushel for these varieties ranged from 60.2 to 64 lbs., Bearded Winter Fife being the heaviest.

Jersey Fultz and Extra Early Oakley, yielding 17.8 and 15.2 bu. per acre and weighing 64.7 and 64.2 lbs. per bu. respectively, were rated as first grade milling varieties.

Fertilizers had no appreciable effect on the yield of grain or straw at the station. A fertilizer experiment made in the western coal measures of the State indicated the need of phosphoric acid; potash had little if any effect.

Field experiments with wheat, W. C. LATTA and W. B. ANDERSON (*Indiana Sta. Bul. 72, pp. 67–76, dgm. 1*).—This bulletin gives the results of variety tests of wheat in 1897–98, and a résumé of field experiments with fertilizers on wheat. In the aggregate 27 varieties of wheat were tested in the 2 seasons. New Columbia, Early Ripe Hybrid, Prolific, and Harvest King produced straw of good strength, and Velvet Chaff, Michigan Amber, Early Ripe Hybrid, Prolific, and Harvest King were practically free from scab which was very prevalent in the locality of the station. Velvet Chaff and Michigan Amber have been grown for 15 years in succession, yielding on an average 29.08 and 28.94 bu. per acre, respectively. So far these 2 varieties have shown no signs of deterioration.

Applications of mixed fertilizer and horse manure were made on 5 series of plats. The series contained 7 plats each and were under different systems of cropping. The mixed fertilizer furnished approximately 2 parts of phosphoric acid, 4.5 of nitrogen, and 3 of potash. In each series 2 plats were fertilized with the mixed fertilizer, 2 with horse manure, and 3 received no fertilizer. The effect of the systems of cropping and the methods of fertilizing are shown in the following table:

Average yield of wheat on fertilized and unfertilized plats.

System of cropping.	Average yield per acre of unfertilized plats.	Average yield per acre of fertilized plats.	Increase over unfertilized plats.
	Bushels.	*Bushels.*	*Bushels.*
Corn and wheat in alternate years	15.68	28.95	13.86
Three course: Corn, oats, wheat	23.44	30.28	7.87
Wheat grown continuously	16.45	21.00	4.72
Four course: Corn, oats, wheat, clover	20.41	26.37	6.23
Corn, beets, oats, wheat, grass	24.20	28.32	4.72

A comparison was made of the light and heavy applications of fertilizers and horse manure, and of the cost per bushel of increase in yield with the same. This showed the horse manure to be the more economical.

Sowing field crops at different rates in Russia (*Rpt. Min. Agr. and Govt. Estates, Division of Rural Economy and Agricultural Statistics, St. Petersburg, 1897, pp. X+50+213, abs. in Selsk. Khoz. i Lyesov., 190 (1898), pp. 717, 718*).—This article treats of sowing grains at different rates, and gives the opinion of practical men in this connection.

It is stated that in hot dry seasons thinly sown crops are more successful than thickly sown crops, and that in southern and southeastern Russia, where the climate is rather dry, crops are usually thinly sown. When the soil is adequately moist and the grain is sown early, thin sowing may be practiced. In general favorable soil conditions and rational methods of sowing tend to decrease the amount of seed necessary to sow a given area.—P. FIREMAN.

The chemistry of the corn kernel, C. G. HOPKINS (*Illinois Sta. Bul. 53, pp. 129–180, fig. 1*).—*The proximate composition of corn* (pp. 130–157).—Following a résumé of the work of various investigators, beginning with that of Gorham in 1821, the author gives the results of his studies on the proximate composition of the corn kernel, describing incidentally the methods of analysis employed, some work on the determination of water and of nitrogen (see p. 819), sampling, and a condenser for use in fat determination (see p. 820).

Ten analyses of pint samples of corn of a single variety grown under uniform conditions "showed a marked degree of uniformity;" but analyses of 50 separate ears of Burr White corn from a uniform field varied widely and "seem to bring out and clearly to establish the fact that there are extreme variations in the chemical composition of corn grown from the purest seed of a single variety and under markedly uniform field conditions." The variations in these samples are shown below:

Variations in the proximate composition of 50 different ears of Burr White corn grown under uniform conditions.

	Ash.	Protein.	Fat.	Carbohydrates.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Maximum	1.74	13.88	6.02	85.79
Minimum	1.09	8.35	3.95	78.92
Difference	.65	5.53	2.07	6.87

"With every constituent the variation is greater than Flechig found with 13 different varieties, and it is nearly as great as found by the Connecticut Experiment Station with about 75 different varieties of corn grown under 90 presumably different conditions."

Thirty duplicate analyses were made of kernels from different parts of ears, dividing the ears lengthwise and into tip, middle, and butt; and in addition the ash and protein were determined in single kernels from different parts of the ear, ears being selected which were relatively high and low in these constituents.

"The concordant evidence of 30 duplicate analyses of parts of ears, of 50 ash determinations, and of 50 protein determinations in single kernels would seem to warrant the conclusion and to establish the fact that the composition of the ear is approximately uniform throughout."

The complete composition of corn (pp. 157–180).—This part consists of

a compilation of studies on the ash constituents, proteids, and carbohydrates of the corn kernel, together with an account of the author's investigations on the oil of corn (see p. 817).

Clovers as green manures, F. T. SHUTT (*Canada Expt. Farms Rpt. 1897, pp. 138–146, pl. 1*).—Experiments were made in green manuring and in soil inoculation. A number of plats were sown to barley and clover and the total clover residue, comprising the dead stems and leaves and the roots to a depth of 9 in., and the amounts of fertilizing constituents contained in this residue the following spring were determined for each plat. Mammoth red clover was sown on 6 plats at different rates, but the plat sown at the rate of 10 lbs. per acre, although not giving the largest amount of total residue, furnished the largest amounts of fertilizing constituents. In the following table the data for the other plats sown with this variety are omitted. The clover residue was collected May 1.

Fertilizer constituent per acre in the residue of different varieties of clover sown with barley.

Variety.	Seed per acre.	Composition.				Residue per acre.	Fertilizing constituents per acre.		
		Water.	Organic matter.	Ash.	Nitrogen.		Organic matter.	Ash.	Nitrogen.
	Lbs.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Mammoth red	10	59.43	33.19	7.38	1.417	5,955	1,978	439	81
Common red	10	72.50	23.61	3.89	1.016	6,125	1,446	238	62
Alsike	6	71.58	22.63	5.79	1.020	3,233	732	187	33
Crimson	24	62.82	33.01	4.17	.827	1,322	478	60	12
Alfalfa	14	61.54	34.79	3.67	1.075	2,212	772	79	26

Inoculation experiments were made with Nitragin on horse beans and mammoth red clover grown in pots. In each case plants were grown on inoculated and uninoculated soil and from inoculated seed. The results in each case were in favor of inoculation. Soil inoculation produced the largest yields in the test with horse beans and seed inoculation in the trial with clover.

Experiments in fertilizing meadows (*Selsk. Khoz. i Lyesov., 184 (1897), No. 2, pp. 457–460*).—Fertilizer experiments with nitrate of soda, superphosphate, kainit, Thomas slag, compost, and barnyard manure were made on a meadow which was divided into 26 plats of three-tenths acre each. The soil was sandy, but contained a good proportion of humus. From the results obtained for 2 years, it is concluded that the use of nitrate of soda alone increases the yield of hay but slightly, while with kainit or with superphosphate and Thomas slag its action becomes more marked. The use of 640 lbs. of superphosphate gave an increase of 2,816 lbs. of hay per dessiatine (2.7 acres). Superphosphate was most effective when applied in conjunction with kainit and with kainit and nitrate of soda. An application of 1,720 lbs. of Thomas slag per dessiatine resulted in an average increase of 2,800 lbs. of hay, while an application of 960 lbs. increased the yield 2,460 lbs. Kainit alone scarcely increased the yield, but 1,600 lbs. of kainit per dessiatine

applied with phosphatic fertilizers produced an increase of 2,000 lbs. in the yield of hay. Compost and barnyard manure exerted a good influence only in the second year.—P. FIREMAN.

Fertilizer experiments with lime, F. H. WERENSKIOLD (*Norsk. Landmansblad, 17 (1898), No. 13, pp. 135–138*).—Cooperative fertilizer experiments were conducted on sandy clay and marshy soils. The plats were 0.247 acre in size and one-half of each plat received a dressing of 300 kg. of lime. The plats on clay soil received in addition to the lime an application of 75 kg. of Thomas slag and 25 kg. of nitrate of soda, while those on marshy soil received Thomas slag and kainit. Düppauer oats were grown on all plats. The chemical composition of the different crops showed marked variations which could not be accounted for by the difference in fertilization.—F. W. WOLL.

Farm crops at the experimental farm for the maritime provinces, G. W. FORREST (*Canada Expt. Farms Rpt. 1897, pp. 273–286*).—The work here described is similar to that previously reported (E. S. R., 9, p. 832). The results of variety tests of spring wheat, barley, oats, peas, mangel-wurzels, carrots, sugar beets, potatoes, corn, and millet, and the results of early, medium, and late sowings of wheat, barley, and oats are tabulated. General statements of the weather conditions and the culture, growth, and yield of the different crops are made.

Farm crops at the experimental farm at Agassiz, British Columbia, T. A. SHARPE (*Canada Expt. Farms Rpt. 1897, pp. 405–420*).—The work here reported in tabular form consists of variety tests and tests of early, medium, and late sowings of spring wheat, oats, barley, and peas, and variety tests of corn, turnips, mangel-wurzels, carrots, sugar beets, potatoes, and fodder crops. Similar work has been previously reported (E. S. R., 9, p. 833).

Report on crops, live stock, etc., in Manitoba (*Dept. Agr. and Immig. [Manitoba] Bul. 57, pp. 28*).—A brief report on the yield of the various kinds of grain and the meteorological conditions for 1898.

The cotton crop of 1897 and 1898 (*U. S. Dept. Agr., Division of Statistics Circ. 9, pp. 16*).—This circular is a report on the cotton crop of the United States in 1897 and 1898. The movement of the cotton crop by rail, water, and wagon is shown for each State, and other statistical data comprising comparative acreage and production in 1896 and 1897, the consumption of American cotton by foreign countries, the yields, cotton consumption, and the number of spindles in operation in 1898 in different countries are given. The crop for this season amounted to 10,821,578 bales of upland cotton and 76,279 bales of sea island or a total crop of 10,897,857 bales produced on 24,319,584 acres.

Cotton, corn, wheat, and forage crops, H. BENTON (*Alabama Canebrake Sta. Bul. 18, pp. 3–12*).—The results of miscellaneous experiments with various crops in 1894 are briefly stated.

Review of literature on plant culture, L. OCHAPOVSKI (*Selsk. Khoz. i Lyesov., 188 (1898), No. 3, pp. 203, 204*).

Jerusalem artichokes grown in the same field for twelve successive years, M. G. LECHARTIER (*Ann. Sci. Agron., 1898, I, No. 1, pp. 121–154*).—The results for each year are given separately. The composition of the different parts of the plant in the fresh and dry state is given and the effect of fertilizer applications on the crop is discussed. It is concluded that Jerusalem artichokes can be successfully grown on the same field without interruption for a series of years with the aid of commercial fertilizers. Applications of commercial fertilizers gave better returns than barnyard manure or mixtures of commercial fertilizers and barnyard manure.

Awnless brome grass (Bromus inermis), J. FLETCHER (*Canada Expt. Farms Rpt. 1897, pp. 229, 230*).—A popular description of the species and of its importance in connection with the forage problem in the western prairie region. "Under irri-

gation . . . brome grass has given on 200 acres of land the enormous yield of 4½ tons of grass per acre."

Review of literature on the culture of beets, L. OCHAPOVSKI (*Selsk. Khoz. i Lyesov., 189 (1898), No. 4, pp. 171–202*).

Clover and grass mixtures for meadows and pastures, WERNER (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 2, pp. 11–15*).—This article describes a number of clovers and grasses and points out their adaptability to certain soils and uses. A number of clover and grass mixtures for meadows and pastures on different soils are suggested.

Cowpea ensilage, T. C. CRENSHAW, jr. (*Country Gent., 64 (1899), No. 2403, pp. 124, 125*).—The method of ensiling cowpeas is discussed and the value of cowpea silage pointed out.

Kafir corn, C. K. MCQUARRIE (*Florida Agr., 26 (1899), No. 10, pp. 146, 147*).—A popular article on growing Kafir corn in Florida.

Review of literature on the culture of potatoes, L. OCHAPOVSKI (*Selsk. Khoz. i Lyesov., 188 (1898), No. 3, pp. 641–672*).

Variety tests of potatoes in 1898, W. BLUMICH (*Sächs. Landw. Ztschr., n. ser., 21 (1899), No. 6, pp. 62, 63*).—A report on the results.

Observations on the yield and starch content of several varieties of potatoes, A. GIRARD (*Ann. Sci. Agron., 1898, I, No. 1, pp. 46–83*).—A number of varieties of potatoes were grown for 10 successive years and the yields and starch content of each variety for each year are reported. It was found that a dry season decreased the yield but increased the starch content, while a wet season had the opposite effect. The varieties recommended, given in their order, are Richter Imperator, Red Skinned, Idaho, and Géante sans Pareille.

Importance of good seed in sugar-beet cultivation, H. W. DIEDERICH (*U. S. Consular Rpts. 1898, No. 218, pp. 451–454*).—This article discusses sugar-beet-seed production in Germany with reference to the needs of the American sugar-beet grower, and advises planting seed of high grade and pure pedigree.

Distance experiments with sugar beets, F. DESPREZ (*Jour. Agr. Prat., 1899, II, No. 4, pp. 125–127*).—It is concluded that the distance between plants is a direct factor in the cost of producing sugar, but that no fixed rule can be laid down, as different distances are required under different conditions.

A new method of growing sugar beets for seed, H. BRIEM (*Bl. Zuckerrübenbau, 6 (1899), No. 1, pp. 1–4*).—A general review of the different methods of growing seed beets, with an outline of a new method.

Cultivation of sugar cane in the Bombay Presidency, J. W. MOLLISON and J. W. LEATHER (*Agr. Ledger (Agr. ser., No. 25), 1898, No. 8, pp. 69*).—Notes on the cultivation of sugar cane, with descriptions of varieties.

The classification of wheat, A. SEMPOLOWSKI (*Deut. Landw. Presse, 26 (1899), No. 12, p. 103*).—A discussion of the classification of wheat and an outline of Eriksson's system of the classification of varieties.

Investigations on the injurious effects of hail on wheat and barley, C. KRAUS (*Deut. Landw. Presse, 26 (1899), No. 14, pp. 137, 138; 15, pp. 149, 150, figs. 4*).

Plowing and harrowing, G. HEUZÉ (*Jour. Agr. Prat., 1899, I, No. 7, p. 240*).—A note on the importance of plowing and harrowing in connection with various crops and rotations.

The use of the land roller in plant culture, E. WOLLNY (*Fühling's Landw. Ztg., 48 (1899), No. 2, pp. 47–50; 3, pp. 85–91*).—The results of experiments show that rolling cereal crops after certain stages of development materially decreases their productive capacity, while the effect during the earlier stages of growth was less marked and in 1 instance slightly increased the yield. Rolling the potato crop during the early stages of growth had a beneficial effect, but when the growth of the plants was advanced the results of rolling did not prove conclusive. The effects of rolling the potato crop varied with different seasons. In general, rolling decreased the number of diseased tubers.

The chemistry of the corn kernel, C. G. HOPKINS (*Illinois Sta. Bul. 53—Abstract, pp. 4, fig. 1*).—An abstract of Bulletin 53 of the station (see p. 844).

Report on experimental manuring, J. A. MURRAY (*Aberystwyth: University College of Wales, 1897, pp. 28*).—Results of cooperative fertilizer experiments on grass, mangel-wurzels, Swedish turnips, and turnips are reported.

Fertilizer experiments with kainit, B. SCHULZE (*Jahrb. Agr. Chem. Vers. Stat. Breslau, 1896; abs. in Centbl. Agr. Chem., 28 (1899), No. 2, pp. 90–92*).—The results of numerous cooperative experiments on potatoes in different parts of Germany in 1896 are reported. The yield was not increased to an important degree by kainit applied to the previous crop. The starch was invariably decreased with the large applications of kainit (1,781.4 lbs. per acre) and usually with the smaller applications (890.7 lbs. per acre).

Fertilizer experiments with potash salts, H. WEHNERT and A. EMMERLING (*Jahrb. Landwirtschaftskammer, Schleswig-Holstein, 1897; abs. in Centbl. Agr. Chem., 28 (1899), No. 2, pp. 92–95*).—Experiments of the same character as those of Schulze, noted above, led to the conclusion that applications of 890.7 lbs. of kainit per acre do not injuriously affect the starch content of potatoes, although the use of double this amount reduced the amount of starch. The economy of using larger amounts is considered doubtful.

The latest information regarding the use of commercial fertilizers in beet culture, J. STRITESKY (*Neue Ztschr. Rübenz. Ind., 42 (1899), No. 3, pp. 21–24*).—A general discussion of the subject.

Top-dressings of sulphate of ammonia and nitrate of soda, KLOEPFER (*Fühling's Landw. Ztg., 48 (1899), No. 3, pp. 114–116; 4, pp. 138–142*).—Sulphate of ammonia and nitrate of soda were applied as a top-dressing to winter wheat in the spring, the sulphate of ammonia being applied about the middle of March, while the nitrate of soda was applied about 1 month later. The records of 5 tests show that the use of sulphate of ammonia was more effective than the use of nitrate of soda.

HORTICULTURE.

Report of the horticulturist, J. CRAIG (*Canada Expt. Farms Rpt. 1897, pp. 90–103, 121–130, figs. 7*).—Descriptions are given of 7 seedling black currants: Beauty, Standard, Success, Monarch, Climax, Star, and Winona, which after 7 years' trial are believed to be superior to any commercial varieties of the same season. These have been selected from about 150 seedlings produced by W. Saunders in 1884.

Ten American and 107 English gooseberries and a few hybrids have been tested since 1893. Few of the English varieties have succeeded. A table gives notes as to the hardiness and health of plants and the color of fruit for 65 varieties of gooseberries. The following varieties are recommended: Red Jacket, King of Trumps, London, Speedwell, and Riccardo.

A test of thinning peaches and plums, made by M. Burrell at St. Catharines, Ontario, is reported. Three six-year-old Hyne Surprise peach trees were chosen; one was thinned June 22, one 10 days later, and the third left unthinned. On the thinned trees the fruit was left about 2 in. apart. At the time of thinning, the fruit on the tree first thinned was ½ to ⅝ in. long and on the tree thinned later, 1 to 1¼ in. long. Thinning was found to increase the total yield and the size of fruits and to decrease the amount of rot. Three trees of Moore Arctic plum were treated similarly to the peach trees. The results

gave the same indications as the peaches though not so marked. The author says: "In both cases it will be observed that the early thinning bore the most profitable results, and it will manifestly pay to commence work of this kind immediately after the fruit sets." A test of thinning apples and plums at the Central Experimental Farm emphasized the results obtained by Mr. Burrell.

A series of trials of methods of storing apples was conducted during the season of 1896–97, beginning in the fall and continuing until the last of July. The tests included 24 varieties of apples and were planned to test the following points: Wrapped *vs.* unwrapped fruit, cellar *vs.* ground floor storage, and close *vs.* ventilated packages. "Specimens wrapped in paper kept best, there were fewer rotten apples, and they lost least by evaporation. The ground floor storeroom did not preserve them as well as the cellar. . . . The tight package preserved the fruit best in storeroom but not in cellar; *per contra* the ventilated did better in cellar than in storeroom." Twenty-six varieties of apples are classified according to their keeping qualities.

Notes are given on some cover crops for orchards. Mammoth red and common red clover completely winterkilled in January, 1896. Alfalfa fared somewhat better. It was noted that where mammoth red clover and alfalfa plats overlapped, both crops came through the winter better than where growing separately. The next fall plats were sown with clover and alfalfa mixed in equal parts. Of the mixture the author says, "The one formed an appropriate complement to the other, the spreading stools of the mammoth red covering the ground with a thick mat beneath the more slender and taller growing alfalfa."

Tests of 48 varieties of bush beans, 19 of pole beans, 11 of Lima beans, 25 of celery, 5 of celeriac, 23 of cucumbers, and 23 of onions are reported in tables, accompanied by brief notes. Cultural experiments were also made with a number of vegetables Seed of peas and beans was soaked 1 hour in solutions of nitrate of soda of different strengths, 1, 2, and 3 oz. of the salt to 1 gal. of water, to ascertain the effect on germination and yield. With peas the percentage of germination was not affected by the treatment, but with the exception of one variety there was a regular increase in yield with the increased strength of solution used. The results with beans were too variable to justify conclusions.

A test of growing a number of varieties of celery in spent hotbed *vs.* cold frames is reported. The average weight per stalk of the hotbed-grown plants was 11 oz. while that of the cold frame plants was over 1 lb. There was little difference as regards quality.

Sowing onion seed at various dates in the hotbed and transplanting the plants into the field was compared with sowing the seed directly in the field at various dates. Transplanting increased the total yield and decreased the quantity of unmerchantable onions.

Trial shipments of fruit (*Rpt. Comr. Agr. and Dairying, Canada, 1897, pt. 7, pp. 20, figs. 2*).—The results of trial shipments of various fruits from Canada to Great Britain are reported. The article gives

quantities of fruit shipped, names of shippers, varieties of fruit, freight charges, prices from some sales, extracts from letters reporting on pears, peaches, tomatoes, grapes, and apples, with a report on shipments of apples, the average prices received, etc. Some of the conclusions are as follows:

"The value of tender fruits in Great Britain depends chiefly upon their condition. To insure the preservation of their condition at its best, it is necessary that a suitable package should be used. It should be (1) strong enough to provide for safe carriage, (2) so constructed as to provide for thorough ventilation, (3) cheap, and (4) of a size convenient for handling. No one package is suitable for all kinds of fruit; but the package for the carriage of every sort of fruit should meet these requirements. . . . Care should be taken in the handling of all tender fruits to prevent bruising. The sorting and wrapping should be done in such a way as to involve the least possible handling of the fruit. If the fruit can be cooled before it is sorted and wrapped so much the less will be the risk of injury. The packing of the fruit should be done in such a way as to keep it firm in the package. An excess of packing, in so far as that prevents circulation of air, is objectionable. Some kinds of packing are liable to become moldy from the dampness caused by evaporation from the fruit. Paper and excelsior packing are of that sort. . . . All tender or soft varieties of fruit should be cooled as quickly after it is picked as is practicable. For long keeping they should be cooled to a temperature between 36 and 40° F., as warm fruit generates heat by the changes which proceed in it. . . . Packages containing warm fruit should never be loaded close in a railway car in warm weather. If a refrigerator car be used, well iced, the generation of heat in cases of warm fruit will more than counterbalance the cooling power of the ice. The fruit will continue to ripen and decay will begin. . . .

"Early ripening and soft varieties of apples should be packed in ventilated barrels or boxes and sent in cold storage. Otherwise a large proportion of them are likely to arrive in a slack and wet condition and to be sold for a price which can entail only loss. . . . The later and firmer varieties of apples can be shipped safely if cooled below 50° F., packed in ventilated barrels, and carried in the holds of steamships provided with air ducts for causing thorough ventilation. . . . Less attention is paid in Great Britain to the variety of pears than to the soundness and nice appearance of the fruit. Pears of a typical and regular shape are wanted and from a medium to a large size. From the trial shipments it appears that a large trade can be created at prices which will be remunerative to the growers here. . . . Tender varieties of peaches, such as Crawfords, can be shipped with safety only when the fruit is picked in a firm condition and cooled to a temperature of under 40° soon thereafter. . . . Tomatoes can be shipped safely. The price that may be obtained regularly will depend so much on the supplies available from other countries that no safe estimate can be made. Those varieties which are of medium size, smooth and regular in shape, solid, with small seed cavities, sell for the highest prices. In the trial shipments last year tomatoes of small size were sold at 9*s.* 4*d.* per case, when tomatoes of large size at the same time sold for only 6*s.* 8*d.* per case. . . . Fruit intended for Great Britain should be picked when fully grown and when beginning to change color. If provision has not been made for the carriage of it in cold storage, the fruit should be picked and packed when of full size, but while still a green color and well glazed. . . . Each tomato should be wrapped in tissue paper or in a light, cheap grade of printer's paper. They should be carefully packed stem end down, so that each one will be held firmly in place when the case is closed. It is doubtful whether a profitable trade can be developed in the shipment of plums from Canada. . . . From the quotations from letters of those to whom Canadian grapes were shipped last season it is evident that there is not yet a demand for them in Great Britain."

The date palm, J. W. TOUMEY (*Arizona Sta. Bul. 29, pp. 102–150, figs. 13*).—Notes are given on the early history of the date palm, the history of the date palm and some of its seedlings in Arizona, the distribution and present condition of the date palm suckers imported by the Department of Agriculture in 1890, of which 39 are now living, methods of propagation and growth, distinction of the sexes, the fruit of the date palm, which varies greatly in many respects, imports of dates since 1860, and insects and other enemies of the date, making especial mention of a scale insect (*Parlatoria victrix*) introduced on imported palms and considered the most serious enemy of the date palm in this country. An especial study is made of the climate to which the date palm is adapted. The climatic conditions in countries where the date palm is native are stated and the conditions in southern Arizona studied comparatively. Tables are given showing the average annual precipitation and mean monthly maximum and minimum temperature at 3 stations in southern Arizona and 6 stations in northern Africa for a period of years. These show a great similarity between the climatic conditions of southern Arizona and the regions adjacent to the Sahara Desert. Not merely these theoretical considerations, but the experimental fact that date palms from both seedlings and imported suckers are now growing and fruiting satisfactorily in various localities, make it probable that date culture will, in time, become an important industry over considerable areas of the interior arid region of the Southwest, of which southern Arizona may be considered the center. As an ornamental tree the date palm flourishes as far north as San Francisco and southern Colorado, but produces fruit of value only in arid regions where the air is dry and summer heat intense. Abundance of water within reach of the roots is necessary to the fruit's perfection. In a comparative study of the soils of the date regions of northern Africa and southern Arizona, it is found that both possess 2 essential features for date culture, namely, paucity of humus and abundance of alkali.

Results of experiments in the cross fertilizing of plants, shrubs, and trees, W. SAUNDERS (*Canada Expt. Farms Rpt. 1897, pp. 60–67, 69, 70, figs. 16*).—This article was read before the British Association for the Advancement of Science, August, 1897. The writer reports work which was begun in 1868 and has been continued at intervals since then.

American varieties of gooseberries were crossed with European varieties with the object of improving the size and quality of the fruit, and obtaining varieties unaffected by mildew, which damages the European sorts so severely. Of several hundred seedlings, Pearl and Red Jacket have become popular sorts both in Canada and the United States. Attempts to cross the European gooseberries with the wild smooth gooseberries (*Ribes oxyacanthoides*) were unsuccessful. With the wild prickly gooseberry (*R. cynosbati*), a number of interesting hybrids were

obtained having the habit of growth of the wild sort but with fruit improved in size and quality.

Hybrids between the white currant (*R. rubrum*) and the black currant (*R. nigrum*), and between the latter and the cultivated gooseberry (*R. grossularia*), were obtained. Of the latter, 28 are still under trial. In all these hybrids the black currant was used as the pistillate parent. The hybrids have the thornless branches of the black currant, but as regards the leaves, flower clusters, and pistils are intermediate between the 2 parent forms. Hybrids of the cultivated black currant and the western wild black currant (*R. floridum*) have characters more or less intermediate between the 2 parents, and some of them appear worthy of cultivation for their fruit.

About 400 hybrids of native and improved American grapes from pollen of European grapes were secured. Many of them were not hardy; some lacked in vigor, some in quality of fruit, and many others bore only staminate flowers. Only a few of these are worthy of cultivation. One of them, the Kensington, is especially productive, has the vigor of growth, character of foliage, and hardiness of the American grape Clinton, and its fruit is intermediate between the Clinton and the European Buckland Sweetwater. Hybrids of the American grape Concord from pollen of European sorts have the long, leathery, downy leaves of the former, with fruit very variable in appearance and quality.

Crosses of red raspberries were all tender and unhealthy. Twenty-four hybrids of the black raspberries (*Rubus occidentalis*) with pollen of the red raspberry (*R. strigosus*) were obtained. All the seedlings rooted from the tips, though less freely than the black raspberries, and a few produced an occasional sucker similar to the red raspberry. The fruit was larger than either parent, of a dark purple color, and combined the flavor of the 2 parents. Most of the efforts to cross the red raspberry with the blackberry (*R. villosus*) were unsuccessful. In several cases seeds were produced, but only part of them germinated and the seedlings were very weak.

Attempts to hybridize apples and pears were unsuccessful. The same was true of attempts to cross the plum with the peach and the plum with the cherry. Crosses of different classes of cherries were only partially successful. Attempts to cross the sand cherry (*Prunus pumila*) with various varieties of the cultivated cherries failed, but a single cross of the sand cherry and the wild plum (*Prunus americana*) was successful. In foliage the hybrid is intermediate, resembling most the plum. A number of crosses have been secured between the more hardy cultivated apples and crab apples and the small Siberian crabs (*Pyrus baccata* and *P. baccata prunifolia*). The hybrids vary considerably, some resembling one parent and some another. None have yet fruited.

Hybrids of the Japanese barberry (*Berberis thunbergii*) and the purple barberry (*B. vulgaris purpurea*) were intermediate between the parents in character of thorns, leaves, flowers, and time of blossoming.

Attempts to hybridize wild and cultivated species of verbena and aquilegia were successful. With the latter many distinct intermediate forms were obtained. Similar attempts with wild and cultivated geraniums were unsuccessful.

The author also reports results of work with various cereals and peas (E. S. R., 10, p. 835).

Horticultural conditions in Europe, L. H. Bailey (*Rural New Yorker, 58 (1899), No. 2559, pp. 93–95*).

Practical arboriculture, Troncet and Deliège (*Arboriculture pratique. Paris: Librairie Larousse, 1898, pp. 163, figs. 190*).—A popular work.

Report of the horticulturist of the experimental farm for the maritime provinces, W. S. Blair (*Canada Expt. Farms Rpt. 1897, pp. 288–306*).—Lists of varieties of various fruits and ornamental plants planted at the farm are given, together with a brief note on the present condition of each. Notes are given on the best varieties of a number of garden vegetables tested at the farm.

Vegetables, flowers, fruits, shrubs, and trees at the experimental farm for the Northwest Territories, A. Mackay (*Canada Expt. Farms Rpt. 1897, pp. 380–398, pl. 1*).—Notes and tabular statements regarding varieties of the plants named above are given.

Fruits, flowers, vegetables, shrubs, and trees at the experimental farm for Manitoba, S. A. Bedford (*Canada Expt. Farms Rpt. 1897, pp. 336–353, pl. 1*).—Brief notes and tabular statements in regard to varieties of the above plants are given.

Truck farming, R. H. Price (*Florida Farmer and Fruit Grower, n. ser., 11 (1899), No. 6, pp. 84, 85*).—Cultural notes on the cantaloupe, tomato, Irish potato, cabbage, snap bean, and sweet potato, which are stated to be among the vegetables that can be grown with profit in the coast regions of Texas and bear shipping a long way.

The vegetable garden, L. J. Troncet (*Le jardin potager. Paris: Librairie Larousse, 1898, pp. 181, figs. 190*).—A popular work. A number of the illustrations are lithographed in colors.

The forcing of vegetables, N. Butterbach (*Amer. Gard., 20 (1899), No. 217, pp. 121, 122*).—A continued article giving practical directions for the forcing of vegetables, together with lists of varieties adapted to this purpose.

The eggplant (Solanum melongena), A. Zega (*Chem. Ztg., 22 (1898), No. 92, p. 975, figs. 2*).—Notes on the size, morphology, and culinary preparation of the fruit of the eggplant. The chemical analyses of 6 samples are tabulated and these are compared with analyses of fruit grown from Japanese seed, which latter contained more water. Notes are also given on the extraction of the coloring matter from the outer layer of the fruit.

The evolution of our native fruits, L. H. Bailey (*New York: The Macmillan Co., 1898, pp. 472, figs. 125*).—This is a companion volume to the author's Survival of the Unlike, and endeavors to show how leading types have come to be. The subjects treated are: The rise of the American grape, the strange history of the mulberries, the evolution of American plums and cherries, the native apples, the origin of American raspberry growing, and the evolution of blackberry and dewberry culture. Various types of berry-like and tree-like fruits more lightly touched upon are the gooseberry, native currants, juneberry, buffalo berry, elderberry, high-bush cranberry, cranberry, strawberry, persimmon, custard apple, thorn apple, and nut fruits. In each case the native species, their distribution and feral variations are discussed. These considerations furnish a key to the origin of many of the cultivated races. Other races are traced back to their origin as a stray seedling, or a hybrid, feral or otherwise. Much prominence is given to the work of those pioneer experimenters who have been most instrumental in the amelioration of native fruits. The work thus

partakes not a little of the nature of historical narrative, and interest in this narrative is much enhanced by the author's lucid and entertaining style. Appended to the description of the American grape are a synopsis of the American species of grapes and a bibliography of American grape literature. Much attention is given to the analysis of the complex relationships existing within the genus Prunus. The author's study of the American Rubi has brought to light a surprising confusion in the nomenclature of the blackberry and dewberry group. He has personally identified the type specimens of this group in European herbaria, and has thoroughly revised the nomenclature to agree with them. The concluding chapter of the book, general remarks on the improvement of our native fruits, is a reprint with minor modifications of a paper originally contributed to the 1896 Yearbook of this Department, pp. 297-304 (E. S. R., 9, p. 558). In tracing the evolution of the native American fruits the author has brought to light many facts of great historical interest and has called attention to the opportunities that await the explorer in the field of history of agriculture.

A new fruit (Salpichroa rhomboidea), F. W. BURBRIDGE (*Sci. Amer. Sup., 47 (1899), No. 1204, p. 19297*).—This fruit, which is also known as Withamia and belongs to the Solanaceæ, is said to be ovoid, "about the size of a small olive, the skin being, when ripe, pale yellow, and filled with soft pulp and seeds." It is said to taste "like a combination of nectarine and pineapple, with a dash of melon thrown in." It is believed that the fruit will never become of much economic value.

Fruits at the experimental farm for British Columbia, T. A. SHARPE (*Canada Expt. Farms Rpt. 1897, pp. 420-433*).—Data in regard to varieties of various fruits are given in notes and tables.

Fruits, H. BENTON (*Alabama Canebrake Sta. Bul. 18, pp. 12-15*).—A list of fruit trees planted on the station grounds. Certain varieties of apples, pears, and grapes are recommended as especially adapted to the soil and climate.

History of the Yellow Newton apple (*Montana Fruit Grower, 8 (1899), No. 37, p. 1*).—Historical and descriptive notes.

Report on plums, G. VESTAL and F. GARCIA (*New Mexico Sta. Bul. 27, pp. 117-132*).—This bulletin gives directions for plum culture. The subjects discussed are soil for plums, the best stocks for plums, planting the orchard, the best time to plant trees, arrangement of trees in the orchard, cultivation of the orchard, irrigation of the orchard, pruning, thinning the fruit, fertilization of plums, and selection of varieties.

Varieties of the domestica group are principally planted in New Mexico. The American and Japanese groups do not succeed, on account of the late spring frosts, the almost certain occurrence of which is a determining factor in the selection of varieties. Descriptions are given of varieties that have fruited in the station orchard, together with tables showing the dates of blooming the last four years; and another table shows the maximum and minimum temperature during the blooming period. A number of varieties not in the station orchard are recommended for trial throughout the Territory.

Olive culture, Z. ESPEJO (*Cultivo del olivo. Madrid: M. G. Hernandez, 1898, pp. 228*).—In addition to treating of olive culture, notes are given of the insect and plant parasites and means for their repression.

The persimmon, J. C. WHITTEN (*Fruitman's Guide, 7 (1899), No. 157, p. 14*).—Notes on the variability, marketing, use, and propagation of this fruit.

Modern viticulture, G. DE DUBOR (*Viticulture moderne. Paris: Librairie Larousse, 1898, pp. 156, figs. 100*).—A popular work.

Summer irrigation of grapes, G. BARBA (*Prog. Agr. et Vit. (ed. L'est), 20 (1899), No. 2, pp. 46-54; 5, pp. 149-158, figs. 3; 7, pp. 202-207*).—Winter and spring irrigation have long been practiced to destroy phylloxera. In this article the advantages of summer irrigation are discussed and methods and appliances are described.

Subwatering and dry air in greenhouses, J. C. ARTHUR (*Amer. Florist, 14 (1899), No. 559, pp. 850-852, fig. 1; Florists' Exchange, 11 (1899), No. 7, pp. 166, 167*).—The

essential features of what is believed to be at present the most perfect system of subwatering are presented.

Ornamental plants for Maine, W. M. MUNSON (*Maine Sta. Bul. 46, pp. 8*).—This is a popular bulletin, calling attention to the importance of ornamentation of rural homes. In determining what to plant, points to be considered are hardiness, season, habit, beauty of foliage, flower, and fruit. The use of native plants so far as possible is recommended, and a number of such are mentioned with the peculiar ornamental adaptabilities of each. For beauty of foliage the golden elder, the golden syringa, the purple berberry (*Spiræa thunbergii*), and stag-horn sumach are recommended. Among shrubs valuable for ornamental purposes on account of their fruit are mentioned the Tartarian honeysuckle, the strawberry bush (*Euonymus*), *Rosa rugosa*, snowberry (*Symphoricarpos*), high-bush cranberry (*Viburnum opulus*), black alder or winter berry (*Ilex verticillata*). Some of the ornamental trees that are adapted to the south central part of Maine are various species of the elm, maple, beech, chestnut, linden, birch, poplar, and oak. Among the most valuable shrubs are the spiræa, lilac, viburnum, and mock orange. Several plants of little or doubtful value are mentioned as such.

How to improve home grounds, J. C. BLAIR (*Gardening, 7 (1899), No. 155, pp. 169–171*).

The ornamental garden, L. J. TRONCET (*Le jardin d'agrément. Paris: Librairie Larousse, 1898, pp. 180, figs. 150*).—A popular work treating of floriculture in general. Descriptive and cultural notes on 750 species of cultivated flowers and shrubs are given. Many of the illustrations are lithographed in colors.

Grafting tea roses for forcing (*Florists' Exchange, 11 (1899), No. 9, p. 226, figs. 3*).—Methods of grafting, with explicit directions for manipulation.

Carnations; notes on recent introductions (*Florists' Exchange, 11 (1899), No. 6, pp. 130–133, figs. 14*).

Indoor grown carnations, C. W. JOHNSON (*Florists' Exchange, 11 (1899), No. 7, p. 164; Amer. Florist, 14 (1899), No. 559, pp. 852, 853*).—The author has obtained better results with carnations grown under glass the year round than by resorting to field culture in the summer months. His cultural methods are described.

Seedling chrysanthemums, F. A. WAUGH (*Garden, 55 (1899), No. 1421, p. 96, figs. 2*).—Notes on a collection of crysanthemums grown from seed said to have come from Korea. The blooms, which were single, or nearly so, are described.

Crinum fimbriatulum and its allies (*Garden, 55 (1899), No. 1421, pp. 92, 93, pl. 1*).—An enumeration of the cultivated species with horticultural notes.

Species of fuchsia (*Garden, 55 (1899), No. 1420, pp. 74–76, pl. 1, figs. 7*).—Botanical and horticultural notes.

Violet culture, W. L. MINOR (*Florists' Exchange, 11 (1899), No. 6, p. 146*).—Notes on the methods of a successful grower. A feature of the method is the sterilization of the soil, accomplished by distributing steam through common land tiles.

FORESTRY.

Report of the foreman of forestry, W. C. MACOUN (*Canada Expt. Farms Rpt. 1897, pp. 247–272, pl. 1*).—A report is given by the foreman of forestry in which the present state of the forest belts at the central experimental farm is described, the progress of work in the arboretum, the planting of ornamental trees and shrubs, and lists of 100 of the hardiest and most ornamental species are given, together with a list of 100 of the best species and varieties of perennials for outdoor growing. Notes are also given on hedge planting with a list of hedge plants growing at the farm, and notes on the condition of and the work in connection

with the ornamental grounds. In connection with the forest belts the best results have been obtained with black walnut, white pine, European larch, white ash, Scotch pine, and canoe birch. Each of these species of trees seems to be adapted to certain conditions of soil cultivation or exposure.

The twenty-sixth convention of German Foresters (*Ztschr. Forst u. Jagdw., 31 (1899), No. 2, pp. 99-109*).—Notes are given on the meeting of the German foresters held at Breslau, August 23–26, 1898.

Forestry in Minnesota, S. B. GREEN (*Minnesota Forestry Association, 1898, pp. 312, pls. 60, figs. 47*).—This handy little book was prepared specially for classes in forestry in the School of Agriculture of the University of Minnesota, and is an elaboration of lectures and notes which the author has used in teaching the elementary principles of forestry. The different subjects treated are embraced under the following heads: Trees and tree growth, forest influences, tree planting, forest management and rate of increase on trees; durability and fuel value of wood; propagation, nursery work, injuries to tree growth, and descriptions of the trees of Minnesota.

Tree planting in Nebraska, E. F. STEPHENS (*Forester, 4 (1898), No. 12, pp. 250-252*).—Some of the problems of tree planting in this State are mentioned and directions given for the proper planting of forests. The varieties of timber best adapted to the conditions of this region are discussed. The author thinks that it will be possible to make the growth of timber over the entire State entirely practicable.

The San Gabriel forest reservation, J. H. BARBER (*Forester, 4 (1898), No. 12, pp. 240-244*).—A brief description is given of this important forest reservation in southern California, and the different forms of arborescent vegetation are enumerated at some length. The principal shrubbery and aborescent vegetation of the cañons and mesas are described, and it is stated that the summits of the ranges are practically unbroken coniferous forests, the principal trees, in order of their numerical importance, being: *Pinus ponderosa, P. lambertiana, P. coulteri, Libocedrus decurrens,* and *Pseudotsuga macrocarpa.*

Forests in their relation to irrigation, H. MICHELSON (*Forester, 5 (1899), No. 1, pp. 9, 10*).—The results following the destruction of the forests in the Ebro and Volga valleys are reported and a comparison is drawn between the conditions now existing in Colorado and the above localities.

Growth of Acacia mollissima in California, J. B. DAVY (*Gard. Chron., 3. ser., 24 (1898), No. 606, p. 108*).—A report is given of a spontaneous seedling of this tree which sprang up in the Botanical Gardens of the University of California in 1895. In the 3 years, without receiving any special care or cultivation, the tree attained a height of 31 ft. with a spread of 24 ft. The trunk was 6 in. in diameter 8 in. from the ground. It flowered sparingly for the first time in the spring of 1898.

Selection in forestry, A. CIESLAR (*Centbl. Gesam. Forstw. Wien, 25 (1899), No. 2, pp. 49-74, figs. 8*).—Experiments are reported with seedlings grown from seed of different origin.

Thinning of woods, J. NISBET (*Jour. Bd. Agr. [London], 5 (1898), No. 3, pp. 292-299*).—The principles underlying proper forest thinning and directions for thinning various kinds of forest growth are given.

The destruction of seed of oaks and pines by Gastropacha quercus, ALTUM (*Ztschr. Forst u. Jagdw., 31 (1899), No. 1, pp. 35-44*).—Notes the destruction of these seeds in the ground and suggests means for preventive measures.

Concerning the multiplicity of forms in Picea excelsa, C. SCHRÖTER (*Vrtljschr. Naturf. Gesell. Zurich, 43 (1898), No. 2-3; abs. in Centbl. Gesam. Forstw. Wien, 25 (1899), No. 1, pp. 21-23*).

DISEASES OF PLANTS.

The effect of aqueous solutions upon the germination of fungus spores, F. L. STEVENS (*Bot. Gaz., 26 (1898), No. 2, pp. 377–406, fig. 1*).—The primary object of the investigations here reported was to ascertain with some degree of accuracy the strength of various solutions which are necessary to prevent fungus growths. The bearing of this question upon the relation of a fungicide to its efficiency is apparent, and it seems important to study the principles underlying their action. By means of the van Tieghem hanging drop, cultures were made of *Botrytis vulgaris*, *Macrosporium* sp. from the fruit of *Datura tatula*, *Glœosporium musarum*, *Uromyces caryophyllinus*, and *Penicillium crustaceum*. The methods of the experiments are fully described and the different chemicals used are enumerated. The solutions used were made by adding the molecular weight of the salt or acid taken in grams to 1 liter of water. In all more than 1,500 cultures were made, from which the author deduces the following conclusions: Mercuric chlorid is the strongest chemical used in its toxic effect upon fungi, while potassium cyanid is remarkably weak considering its great toxic action on animals. Various fungi offer different resistance to poisons, and the limits of resistance may vary in the same species. Alcohol and sodium chlorid seem to have a stimulating effect.

In general the results obtained accord with the theory of hydrolytic dissociation. A chemical may be twice as powerful as another against one fungus, but may act upon another in an entirely different ratio. The spores of fungi are much less susceptible than the roots of seedlings. Bordeaux mixture, as ordinarily formed, contains far more copper than would be necessary if dissociated into copper ions. The cathions Hg, H, and Cu and the anions CN, CrO_4, Cr_2O_7, and OH are poisonous, while the halogen anions are not poisonous.

Uromyces offers the greatest range in its susceptibility to poisons. Secondary spores of anthracnoses increase in abundance under the adverse conditions of a toxic solution. Spores protected by actual contact with others may germinate and the tube grow in a solution which would have prevented the germination of the spore had it been in contact with it. Peculiar knotty or twisted hyphæ frequently result from the attempt to grow in a poisonous solution. A spore may be able to germinate and grow slightly in a solution in which it is unable to attain its full development. Potassium permanganate at certain strengths acts as a selective stain, differentiating the uredo from the teleutospores of *Uromyces caryophyllinus*.

Bread may be moistened with a solution which will prevent the germination of the spores, but after evaporation of the solution the spores can then grow. An occasional spore may germinate and grow perfectly normally in a solution which prevents hundreds of normal spores around it from germinating. Penicillium in a nutrient medium offers

greater resistance to poisons than do any of the other fungi investigated. Uromyces does not diminish in vigor of growth with the increased strength of the poisons, but it does diminish in the percentage of spores which germinate.

Influence of wet weather upon parasitic fungi, B. D. HALSTED (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 416*).—The author states that there is apparently some connection between weather and the occurrence of parasitic fungi. During 1898 the month of May was remarkably wet and the following June brought an abundance of parasitic fungi. Among these were the rusts of hollyhock, cedar, and mandrake; smuts of lily, spring wheat, and oats, and peach leaf-curl fungus. It is stated that the year 1889 was noted for its wet summer and also for the destruction of potatoes by rot. In 1897 July was phenomenal for its heavy precipitation, 11.42 in. This was followed by a serious outbreak of potato rot, causing a wholesale destruction of the tubers. *Phytophthora phaseoli* was discovered in the wet summer of 1889 and reappeared destructively in 1897. The records of the New Jersey Station show that both the wet years mentioned were noted for the abundance of black rot of grapes and rust of apples. In 1894 the growing season opened with a wet May and closed with a rainy September. There were long periods of cloudy weather and often it was hot and showery. This year witnessed an unprecedented outbreak of fire blight of apple, quince, and pear. In 1896 there was a rainy June and July and during this period the asparagus rust made its appearance in the eastern United States to an alarming extent, and in 1897 it was even more abundant. "There are not sufficient data for safe and substantial generalizations, but heavy rainfalls in spring seem to induce rusts in grains and orchard and garden crops, and the fire blights of fruit trees. Midsummer precipitations favor the decay of fruits, particularly the stone fruits, and the rotting of potatoes. Rainfall does not express all the meteorological conditions that need to be taken into consideration in this connection."

Concerning the etiology of some diseases of cultivated plants, F. CARVARA (*Staz. Sper. Agr. Ital., 30 (1897), No. 6, pp. 482–507*).—The author gives extended observations upon what he terms the tuberculosis of the grape, necrosis of grape stems and shoots, necrosis of mulberry, and tuberculosis of the peach. All these diseases are said to be of bacterial origin. The author claims to have isolated the organisms, cultivated them on artificial media, and produced the diseases by inoculation from cultures.

Tuberculosis of the grape is said to greatly resemble olive tuberculosis, but may be distinguished by the greater number of small tubercles. These tubercles form in groups under the periderm, causing protuberances, resulting in the breaking of the cortex. This takes place especially near the nodes bearing the bunches of grapes, and when the vine becomes old the branches are nearly surrounded by them. The affected

plants bear sickly looking leaves of a yellowish-green color. The nodes where the tubercles are formed are 2 or 3 times their normal size. The organism causing this disease is 1 to 2 μ in length, cylindrical, with rounded ends. It grows more rapidly upon gelatin than on agar. Comes is said to have identified the organism as *Bacterium gummis*, but the author considers it identical with *Bacillus ampelopsoræ*. The disease is thought to be propagated quite extensively through the roots, which were observed to bear numerous excrescences.

The necrosis of the grapevine is said to be the same disease as that called *mal nero*, or bacterial gummosis. It is characterized by the sickly appearance of the shoots of the present year's growth, which are also much shorter than healthy ones. They are of a yellowish color, with characteristic gangrenous black ulcers at the point of connection of the shoot with the vine proper. These ulcers are sometimes of a circular form, but more often extend in long narrow strips half the length of the internode. Accompanying these there is a depression or corrosion of the tissues, the woody fiber and even the pith being affected. The leaves become yellow and wither and the bunches of grapes are arrested in their development and completely dried up. The bacterial origin of this disease is said to be well established, and according to the author is *Bacillus vitivorus*. Cultivated on gelatin the bacillus is 1 to 2 μ in length. It possesses considerable vitality, since cultures remained alive all winter in the laboratory where the temperatures varied from 4 to 25° C. Six successful inoculation experiments with the organism are reported. Close pruning and sulphuring the bunches of grapes with equal parts of sulphur and lime, after which the vines are sprayed several times with Bordeaux mixture, is said to be efficient in arresting the disease.

Necrosis of mulberry trees has received considerable attention on account of its destructive nature. The author has isolated 2 bacteria, one of which is probably *Bacillus cubonianus* and the other a new species to which the name *B. mori-carneus* is given. Both organisms have been cultivated on artificial media and their characteristics are described.

The peach tuberculosis is said to be caused by *Clostridium persicæ-tuberculosis*, a new species of bacteria, the characteristics of which are described at some length. The disease, which has occurred quite abundantly in the vicinity of Pavia, is characterized by the presence of tubercles upon the branches of 1 or 2 years' growth, but are rarely found on older ones. They are of globular or flattened globular form, 1 or 2 cm. in diameter. At first they appear as slight protuberances, corresponding ordinarily to the first appearance of a bud, and they cause the epidermis to be raised, constituting a sort of hyperplasm of the cortical parenchyma. The presence of these tubercles usually kills the branch, although it may survive until the second year. The tissues affected are not confined solely to the bark, but extend to the woody

cells, which become more or less transformed. This disease in the orchard examined was exceedingly abundant, and the small tumors were found on 30 out of 50 trees and in a few hours as many as 500 affected branches were cut out. The peach tuberculosis has frequently been confused with the bacterial gummosis of pomaceous fruits, but the author maintains that they are very distinct. It is said that by pruning the course of this disease may be arrested, although no experiments are reported where its efficiency has been tested.

Fungus diseases, J. CRAIG (*Canada Expt. Farms Rpt. 1897, pp. 110–120*).—Notes are given of a number of the more common parasitic diseases of cultivated plants, and experiments are reported on the effect of shading on the production of gooseberry mildew. The plants were shaded by planting hills of corn on the south, east, and west sides of the gooseberry plants. The results obtained seem to indicate that the shading reduced the amount of gooseberry mildew, and this experiment is to be repeated on a more extensive scale.

Attention is called to the attack of *Heterosporium gracile* on species of cultivated iris, and applications of Bordeaux mixture are recommended as a preventive treatment.

A dry rot of apples which is said to be caused by a fungus closely resembling *Penicillium glaucum* is briefly described.

A peach disease which has been observed for several years is described, the characteristics of it being abnormally thickened annual shoots; a marked increase in the buds; tufted broom-like growths involving a single twig or branch, or sometimes even the entire top of the tree, the color of the foliage being somewhat lighter green than normal and the leaves much narrower and contorted. The symptoms of this disease are somewhat like those of peach rosette, and specimens submitted to the Division of Vegetable Physiology and Pathology of this Department were identified as resembling rosette, but no positive opinion was given. On account of the serious nature of this disease the author recommends the cutting and burning of all affected trees.

A serious grape disease has been under observation for several years. The affected vine may be recognized by the leaves, which become light yellow in color; the canes are shortened and the tendrils often abortive. The root system is very imperfect. Microscopical examination of affected plants did not reveal any fungus, bacteria, or insect that could be positively identified as the cause of this disease. Assuming that the trouble may be due to a lack of nutrition, a series of experiments has been begun with different fertilizers and these will be continued for some time.

Experiments for the control of potato scab were conducted in which 2 varieties of potatoes were treated with various fungicides. The ones used were corrosive sublimate, kainit, nitrate of soda, potassium sulphid, sulphur, formalin, and lysol. The results obtained by these experiments showed that there was a marked difference in the 2 varieties in their susceptibility to the potato scab, one variety being affected

very little, while in the other 90 per cent of the tubers of the checked plat were affected by the scab. In these experiments the lysol solution gave the best results, followed by corrosive sublimate. The use of formalin gave very unsatisfactory results, quite at variance with the results of J. C. Arthur at the Indiana Station (E. S. R., 9, p. 456).

Brief notes are given of the injury done to roses by growth of mucor, and on the leaf spot of celery.

Experiments were also conducted with the fungus parasite of the San José scale, from which it appears that this parasite (*Sphærophila coccophila*) can not be looked upon as a practical preventive of the scale in southern Ontario.

Experiments were conducted with corrosive sublimate, kainit, nitrate of soda, potassium sulphid, formalin, and lysol for the prevention of bean anthracnose. One and one-half per cent solutions of lysol gave satisfactory results, followed by formalin and potassium sulphid. If further trials of these fungicides should corroborate the results given, lysol would supersede copper sulphate as a preventive of bean anthracnose, as the results obtained are more satisfactory than those in former experiments with copper sulphate.

Rust in wheat during the dry season of 1897, D. McAlpine (*Agr. Gaz. New South Wales, 9 (1898), No. 12, pp. 1421, 1422*).—Notes are given of a number of specimens of wheat that were submitted to the author to ascertain the presence of rust. The season had been an exceedingly dry one and was considered unfavorable for rust growth, but the specimens showed the presence of a few rust pustules and associated with them were 2 saprophytic fungi (*Cladosporium herbarum* and *Septoria glumarum*).

As bearing on Eriksson's hypothesis (E. S. R., 9, p. 118) of the existence of a symbiotic mycoplasma in wheats whereby the rust is carried from one crop to another, the author states that he grew seed of 10 varieties of wheat that had been sent him from Sweden by Eriksson and although they were all attacked by either one or both of the native species of rust, they were entirely free from the yellow rust (*Puccinia glumarum*), the rust which attacks wheats most severely in Sweden. This evidence, though not conclusive, on account of the fact that the variety of wheat was selected as one resistant to the yellow rust, seems to be somewhat opposed to the theory advanced by Eriksson.

The treatment of sooty mold (fumagine), L. Degrully (*Prog. Agr. et Vit., 30 (1898), No. 52, pp. 749–751*).—The author mentions various attempts to control this disease. Among the winter treatments recommended are spraying with kerosene emulsion and the use of sulphuric-acid washes. It is stated that during the past season in Gironde a solution composed of water 100 liters, fat lime 20 kg., and crude petroleum 10 kg. was used. Another formula said to have been used with success was crude petroleum 5 kg., crude naphthaline 8 kg., quick lime 25 kg., and water 100 liters. The author believes that the absolute efficiency of these solutions has not yet been established, and has made arrangements to have them tested on a greater scale.

Notes on Stewart's sweet-corn germ (Pseudomonas stewarti), E. F. SMITH (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 422–426*).—The author reports having received from F. C. Stewart, of the New York State Station, in 1898 pure cultures of the organism, which had been described as the cause of a disease of sweet corn (E. S. R., 9, p. 1056). He states that with some exceptions, as far as he has studied it the organism possesses the characters assigned to it by Stewart, and some others which will help to readily distinguish it. The behavior of the organism on various media is fully described. It seems to be an undescribed form, is motile by a single polar flagellum, and has been designated *Pseudomonas stewarti*, n. sp. The following synopsis of characters is given:

"A medium-sized rod rounded at the ends and motile by means of one polar flagellum, size 0.5 to 0.9 by 1 to 2μ, no spores observed; found in enormous numbers in the vascular bundles of corn (*Zea mays*) associated with a destructive disease of which it is probably the cause; color in the host plant and in culture media yellow (buff to chrome or ocher, occasionally a pale, dirty yellow); aerobic and facultative anaerobic; grown in all ordinary culture media; bears alkali well (soda); and plant acids extremely well; grows luxuriantly in Uschinsky's solution; growth enormously stimulated by cane sugar, grape sugar, and galactose; growth not favored by 5 per cent doses of lactose, maltose, dextrin, mannite, or glycerin in nutrient starch jelly; diastatic action feeble, *i. e.*, able to obtain food from starch only with much difficulty; produces alkalies in all sorts of media and acids in the presence of grape and cane sugar; reduces litmus slowly; does not liquefy gelatin; does not liquefy Loeffler's blood serum; grows well at summer temperatures of 25 to 30° C.; does not die out quickly in culture media; does not produce gas; sensitive to light; occurs in New York and Michigan, and may be looked for in all parts of the United States."

The time for treatment of black rot in southeastern France, J. PERRAUD (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 19, pp. 1377–1379*).—In a previous paper (E. S. R., 9, p. 761) the author has shown in general the time of the different invasions of black-rot fungus in the vineyards of southeastern France. In the present paper he reviews experiments conducted in 1896 and 1897 for the prevention of this disease. In 1896, the times of the appearance of the black-rot fungus were May 26, June 10 and 22, July 5 and 18, and August 1 and 17; and sprayings were given the vines on the following dates: May 5 and 15, June 1, 13, and 25, and July 8, 18, and 30. In summarizing the results of the work in 1896, it is stated that 4 applications of fungicides, made May 15, June 1 and 25, and July 18, were sufficient to entirely protect the crop.

In 1897 the black rot appeared in the vineyards May 28, June 23, July 6 and 20, and August 4. The sprayings in this year were made on May 1, 12, and 20, June 2 and 26, July 3 and 17, and August 3. In this year, although the vineyard was injured by a heavy hailstorm, 98 per cent of the grapes were saved by treatments given the vines on May 12, June 2 and 26, and July 13; and the author states that the preservation would have been complete had there been a supplementary treatment July 3.

Generalizing from the experiments of the years 1896 and 1897, the

author states that 4 applications are all that are usually necessary, and these should be given the vines at times which coincide with certain easily distinguished periods of growth, namely, (1) when the young shoots are 15 to 20 cm. in length; (2) at the time when the flowers are beginning to open; (3) at the close of the flowering period, and (4) when the grapes have attained about one-half their full size. The most critical time in combating the black rot is stated to be the fortnight following flowering and the last half of July.

In conclusion, the author states that the 4 applications given as above will usually be found all that are necessary, but occasionally supplemental treatment will be necessary if a sudden attack of the fungus should be imminent.

The life history and characteristics of the pear-blight germ, M. B. WAITE (*Proc. Amer. Assoc. Adv. Sci., 17 (1898), pp. 427, 428*).—The author states that the first appearance of the germs on the new growth of the season in the spring appears on the nectar disks. The bacilli live and multiply in the nectar and are able to infest the host without puncture or injury through the nectar glands. The distribution from flower to flower and tree to tree is through the agency of insects. Infection also occurs on young shoots and less frequently on the fleshy bark through injuries. No evidence has been found that the germs are carried by the wind. The blight germs usually die out in the twigs which are blighted, but in certain cases they manage to keep alive through the summer, making slow growth in the fleshy bark. Such cases may succeed in living over a winter, winter weather being favorable to the longevity on account of moisture and low temperature. These hold-over cases of blight are apparent in the spring by the exudation of considerable quantities of gummy matter full of bacilli. These are visited by insects, principally flies and wasps, which carry the germs to the newly opened flowers, thus completing the life cycle.

The characters of the bacillus are briefly given, its appearance when cultivated upon various media described, and certain statements formerly made which are now known to be erroneous are corrected. The color of the germ mass, which has previously been stated to be yellowish white on the potato, must have come, in the author's opinion, from impure cultures as the true pear-blight germ is always white. No gas is formed, contrary to previous expressions, and while the germ produces some acids, no butyric acid is produced in its decomposition. It has been stated that starch is decomposed and used as food by the germ in cultures, but in the author's experiments this has never been demonstrated. It has also been claimed that the germ lives over winter in the soil, but so far the author has failed to find any evidence of this fact.

Notes on some diseases of southern pines, H. VON SCHRENK (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 414*).—Of the numerous parasitic fungi attacking the species of southern pines, *Trametes pini* is said

to be by far the most destructive. This fungus attacks the older trees, entering through a knot and causing disintegration of the heartwood. The mycelium dissolves portions of the wood fibers, at first changing them to cellulose. After a time the solution stops and the wood then appears full of holes with a white lining, the holes separated by lamellæ of comparatively sound wood. The wood not destroyed seems to be protected against the attacks of fungus ferments by some substance which infiltrates into the wood cells. The author thinks that in the case of pines attacked by this fungus, a compound allied to the humus compounds, is present which gives the wood a brown color.

Another fungus, *Trametes radiciperda*, enters the trees through the roots; the mycelium passes up into the trunk, causing decay similar to that described above. This disease has been found destroying numerous trees of *Pinus palustris* and *P. echinata*.

Plant diseases observed in Denmark during 1896, E. ROSTRUP (*Tidsskr. Landbr. Planteavl., 4 (1897); abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 278–280*).—Notes are given on the principal fungus and insect injuries to cereals, grasses, leguminous forage plants and garden crops.

Plant diseases appearing in Italy in the year 1897, G. BRIOSI (*Bol. Not. Agr., 19 (1897), pp. 124–133; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 273–277*).—Notes are given on the more important fungus diseases observed during the period indicated.

Sensitiveness of certain parasites to the acid juices of the host plants, E. F. SMITH (*Bot. Gaz., 27 (1899), No. 2, pp. 124, 125*).—In a brief abstract the author states that the comparatively slow progress of *Pseudomonas campestris*, *P. phaseoli*, and *P. hyacinthi* when inoculated into the host plants, even in enormous numbers, led to the belief that the restraining influence must be the acid juices of the cabbage, bean, and hyacinth. In studying these organisms all the fluids in which they were grown were tested, being titrated with caustic soda and phenolphthalein, so that the exact grade of acidity which retarded growth was definitely known. The full results of the author's experiments are promised in another paper.

The plant parasites of coffee, G. DELACROIX (*Rev. Cult. Coloniales, 4 (1899), No. 21, pp. 34–38*).—The parasites are said to be several species of Loranthus, an alga, *Cephaleuros coffeæ*, a number of Ascomycetes, and 2 species of Hemileia.

Concerning the symbiotic mycoplasmic theory in grain rusts, H. L. BOLLEY (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 23, pp. 855–859; 24, pp. 887–897; 25, pp. 913–919, figs. 6*).—This paper was presented to Section F of the American Association for the Advancement of Science at the Boston meeting August, 1898. An abstract of the paper is given in the proceedings of the Association (E. S. R., 10, p. 653). The author believes that Eriksson's theory (E. S. R., 9, p. 118) is not well founded, and that the infection is by the distribution of uredo spores by the winds.

Some important wheat diseases, C. O. TOWNSEND (*Maryland Sta. Bul. 58, pp. 123–127*).—Popular notes are given of the wheat smuts and rusts with suggested remedies. The author states that in certain parts of the State a Septoria (probably *S. glumarium*) is more or less prevalent.

Red rust of wheat, H. GARMAN (*Kentucky Sta. Bul. 77, pp. 121, 122*).—A brief popular summary is given of a paper presented by the author for a farmers' institute at Shelbyville, Kentucky, in which is summarized the present state of information relative to the cause of grain rusts.

The asparagus rust (*Bul. Soc. Cent. Hort. Seine-Inférieure, 2. ser., 2 (1898), No. 5, pp. 361–363*).—Notes the presence and injurious effects of *Puccinia asparagi* and

recommends spraying the beds with a solution of copper sulphate, 3 kg. to 100 liters of water.

On the relation of two species of Puccinia on Stachys, P. MAGNUS (*Ber. Deut. Bot. Gesell., 16 (1898), No. 10, pp. 377–385, pl. 1*).—Notes are given on *Puccinia harioti* and *P. vossii*.

Diseases of carnations, P. SORAUER (*Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 283–295*).—The author describes at some length 9 diseases of carnations that have been observed in Germany.

Root rot of alfalfa and sugar beets, V. PEGLION (*Bol. Ent. Agri. e. Patol., 4 (1897), pp. 367–369; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, p. 300*).—Brief notes are given on the attacks of *Rhizoctonia violacea* on the alfalfa roots and *Dematophora necatrix* on the beet roots.

The bacterial wet rot of potatoes, C. WEHMER (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 13, pp. 540–546; 14, pp. 570–577; 15–16, pp. 627–635; 17–18, pp. 694–700; 19, pp. 734–739; 20, pp. 764–770; 21, pp. 795–805, pls. 2*).

Combating potato diseases with Bordeaux mixture, E. GUTZEIT (*Fühling's Landw. Ztg., 48 (1899), No. 4, pp. 142–148*).—Three varieties of potatoes were thoroughly sprayed with Bordeaux mixture and the results of the treatment are given. No Phytophthora appeared on the sprayed plants, and the yield of these plants as compared with the checks was as 161 to 100. There were more large potatoes and the specific weight and starch content were considerably higher, which was attributed to the fungicide.

A root disease of mulberry trees, N. ICHAKAWA (*Forstl. Naturw. Ztschr., 7 (1898), No. 12, pp. 423–428*).—A disease of mulberry trees that has been known in Japan for at least 17 years is described. It is said to be caused by *Helicobasidium* sp. attacking the roots of the trees.

On the occurrence and prevention of grape diseases in Germany in 1896 (*Abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 307–310*).—The diseases and injuries are classed under those induced by climatic influences, those due to insects, those caused by parasitic fungi, and those whose origin is unkown.

A bacteriological study of pear blight, LILLIAN SNYDER (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 426, 427*).—The author has made a study of the life history of the true pear-blight bacillus (*Micrococcus amylovorus*), but the principal part of the paper is taken up with the description of a second germ, which very frequently accompanies it. This germ was isolated and carried through various cultures and inoculation experiments made, and the author concludes that the second germ isolated from the tree in connection with the true blight is really saprophytic.

The leaves of the Red Astrachan apple immune from the attack of Gymnosporangium macropus, W. J. BEAL (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 421*).—The author desiring to cultivate this fungus in the botanic gardens at the Michigan Agricultural College secured young cedars well supplied with living galls and planted them almost in contact with 2 young apple trees of the Red Astrachan variety. Artificial transfers were made of the spores from the cedar to the apple and numerous examinations made, but no traces of the fungus could be found on the apple leaves. The test was repeated in 1898 with similar results, and a letter from L. R. Jones, of the Vermont Experiment Station, is quoted, in which it is stated that he had tried to induce the teleutospores of red cedar to attack red astrachans with negative results.

On the occurrence of a yeast form in the life cycle of the black rot of apples, W. B. ALWOOD (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 422*).—The author reports the discovery of a yeast form in laboratory culture of the fungus causing the black rot of apple (*Sphæropsis malorum*). This yeast form has been isolated and reinfections made on the fruit of apple produced the fruiting bodies characteristic of the black-rot fungus.

ENTOMOLOGY.

Report of the entomologist and botanist, J. FLETCHER (*Canada Expt. Farms Rpt. 1897, pp. 187–230, figs. 18*).—Notes are given on the jointworm (*Isosoma* sp.), the grain plant louse (*Siphonophora avenæ*), and grasshoppers which affect cereals. The pea weevil (*Bruchus pisi*) and pea moth (*Semasia nigricana*) are described at some length and suggestions given for their destruction. Insects which attack root crops and vegetables are described. Among them are mentioned cutworms, blister beetles, carrot rust fly (*Psila rosæ*), and spinach carrion beetle (*Silpha bituberosa*). Insects affecting fruits are described, the more important of them being the tent caterpillar, cankerworms, shot borer (*Xyleborus dispar*), oyster-shell bark louse (*Mytilaspis pomorum*), apple maggot (*Trypeta pomonella*), apple fruit miner (*Argyresthia conjugella*), various species of plant lice, strawberry crown borer (*Tyloderma foveolatum*), currant maggot (*Epochra canadensis*), native currant sawfly (*Gymnonychus appendiculatus*), and the San José scale. The life history and notes on the attacks and methods of prevention are given for these different insects.

A report on the management of the apiary by J. Fixter is appended in which a chronological history of the bees during the season of 1897 is given. Experiments in wintering are also reported, in which 15 colonies were put into winter quarters in the cellar and placed on shelves beginning 18 in. from the floor. Under the back end of each hive was placed a 3-inch block by which each hive was raised so as to secure ventilation. These hives were put in the cellar with the tops and bottoms of the hives left on. Two colonies were stored in a root house, 2 were placed in a pit dug in the side of a hill, and 2 were wintered in a wood shed. The mode of wintering which gave the best satisfaction was the first. The other methods were more or less unsatisfactory, owing to a number of causes.

The report concludes with a brief account of the distribution and value of awnless brome grass in Canada.

Experiments with bees, S. A. BEDFORD (*Canada Expt. Farms Rpt. 1897, pp. 334, 335*).—An experiment is reported in wintering bees in which the hives were placed 6 in. from the floor and protected with a piece of old woolen carpet placed under the wooden cover. When placed in the cellar each colony had 30 lbs. of honey, which proved more than sufficient for the winter, and all the hives wintered successfully. The temperature of the cellar, as shown by a self-registering thermometer, remained steadily between 40 and 50° F.

In 1896 some difficulty was experienced with persistent swarming of the bees, resulting in the weakening of the colonies, and in the following year most of the brood frames were filled with bees and a large upper story filled with wire foundations was added and the frames extracted as required. This gave an abundance of room and no swarming whatever occurred and all the colonies became strong before fall. An average of 45 lbs. of extracted honey was taken from each hive.

A list of plants which are visited by bees is given, arranged in the order of flowering.

Miscellaneous injurious insects, C. V. PIPER and R. W. DOANE (*Washington Sta. Bul. 35, pp. 21, figs. 13*).—On account of the rapidity with which the San José scale has spread over the State and the great amount of damage it is causing, the authors have given descriptive notes and an account of the life history of this insect. The most approved remedies for the destruction and prevention of the distribution of the scale are given.

The bud moth (*Tmetocera ocellana*), which was unknown within the State 3 years ago, is now reported as having gained a foothold in several sections and has done much damage wherever noted. The appearance of the insect at different stages of development is described. The remedies suggested for combating it are spraying trees with Paris green during the early stages of the larvæ, or just as the larvæ are leaving winter quarters and beginning to eat their way into the buds. On account of the peculiar habits of this insect these are about the only periods at which it can be successfully treated.

The strawberry crown moth (*Sesia rutilans*) is figured, its habits and life history described, and remedies suggested. The best, surest, and easiest way to control this pest, the authors state, is to watch the plants early in the spring and dig out and destroy by burning any dead and dying plants, or any that from weak condition seem to indicate that they may be infested.

The plum sphinx (*Sphinx albescens*) is figured and described. When abundant the trees should be sprayed with Paris green for the prevention of injury. Hand picking, however, will ordinarily be sufficient to keep these insects in check. The sphinx is parasitized by a small wasp-like insect (*Rhogas fumipennis*).

Illustrated notes are given on the tomato worm and blister beetles, with suggested remedies.

The strawberry thrips and the onion thrips, A. L. QUAINTANCE (*Florida Sta. Bul. 46, pp. 77–114, figs. 12*).—The author reports the occurrence of *Thrips tritici* during the spring seasons of 1896 and 1897, when it proved quite destructive to strawberries and other crops. The insect is said to be present in Florida throughout most of the year, but it was only during March, April, and May in the 2 seasons indicated that serious damage was done. In both these seasons the strawberry crop of Florida was reduced fully one-third by the action of these insects. The thrips attacks the pistils of the strawberry most frequently, resulting in the blighting of the ovaries. In addition to the attacks on the pistils, the petals, particularly at their bases, and also the stamens are attacked to some extent. The injurious effect of these insects seemed to be in preventing the fertilization of the ovules. Since the stigmas are attacked, the normal fertilization is greatly retarded, if not entirely prevented.

In March, 1898, the thrips was very abundant about Lake City and

in April attacked the foliage of various plants, such as Le Conte pears, Kelsey plums, English peas, parsley, and endive. The damage to the flowers of the strawberry was not so severe as in 1897, but blackberries, dewberries, and roses suffered considerably more.

The life history and habits of the insect were studied, from which it appears that the life cycle of *Thrips tritici* is quite short, requiring but 12 days. The eggs are deposited in the tissues of the infested plants and hatch in 3 days. The larval stage lasts about 5 days, during which time the insect makes 2 molts. The nymph stage continues for about 4 days, in which time no food is taken.

In 1897–98 experiments were conducted with a number of insecticides for the control of this pest, and while a number of them proved valuable, the laboratory experiments showed that rose-leaf insecticide, whale-oil soap, kerosene emulsion, pyrethrum powder, and Hammond's thrips juice were all efficient in destroying the insect under laboratory conditions. For field purposes the most successful insecticides are rose-leaf insecticide, whale-oil soap, and kerosene emulsion, but on such fruits as the strawberry, blackberry, etc., the author recommends the use of the rose-leaf insecticide, since the oils present in the other 2 give a disagreeable flavor to the fruit.

During the spring seasons of 1897 and 1898 *Thrips tabaci* has proved very destructive to onions, cauliflower, and cabbage in the vicinity of Lake City. These insects were first noted about the middle of April, when they were observed to be infesting onions in the station gardens, and continued their destruction until about July 1, when they gradually disappeared. This species is injurious to the foliage of many plants. On onions it chafes the epidermis of the green leaves, causing them to dry out, whiten, and frequently die. On cabbage and cauliflower the effects are about the same. The life history and habits of this insect show that it has a somewhat longer life cycle than that of *T. tritici*, requiring about 16 days for its completion. This insect goes through 3 molts during its life cycle. The egg state lasts about 4 days, the larval stage 8 days, and the nymph stage 4 days.

This species of thrips can be successfully combated by the use of the same insecticides as recommended for the previous species except that the solutions should be somewhat stronger.

Report on the San José scale in Maryland and remedies for its suppression and control, W. G. JOHNSON (*Maryland Sta. Bul. 57, pp. 116, figs. 23*).—Preliminary to a discussion of the San José scale, the author reviews the entomological work of 1896 and 1897 and gives an extended account of the introduction, present condition, distribubution, and life history of the San José scale. The operations conducted in Maryland for destroying the insect and preventing its further introduction are given at considerable length. Fumigation with hydrocyanic-acid gas is considered the most successful treatment. Experiments with whale-oil and other kinds of soap and kerosene are reported upon and the result of their application in Maryland is stated.

Insects injurious to currants and gooseberries, C. V. PIPER and R. W. DOANE (*Washington Sta. Bul. 36, pp. 16, figs. 8*).—The authors state that there are at least 3 different species of insect in the State which attack and destroy the fruit of the currant and gooseberry. These insects are the dark currant fly (*Rhagoletis ribicola*), yellow currant fly (*Epochra canadensis*), and gooseberry fruit worm (*Dakruma convolutella*). The insects are fully described and their habits and life histories given and various remedies suggested for their prevention. Illustrated notes and life histories are also given of the following insects which are injurious to the foliage of the currant and gooseberry: Native currant sawfly (*Gymnonychus appendiculatus*), pepper-and-salt currant moth (*Eubyia cognitaria*), currant aphis (*Myzus ribis*), currant borer (*Sesia tipuliformis*), and western pulvinaria (*Pulvinaria innumerabilis occidentalis*).

Notes on horntails and their host plants, W. LEISEWITZ (*Ztschr. Forst Naturw., 7 (1898), No. 12, pp. 439–442*).—The author enumerates a number of species of horntails, arranging them according to the woody plants upon which they live. The species are as follows:

Spruce—*Sirex gigas, S. spectrum, S. juvencus, S. noctilio, Xiphydria camelus*; pine—*Sirex gigas, S. juvencus, S. noctilio, Xiphydria camelus*; Abies—*Sirex gigas, S. spectrum, S. juvencus, Xiphydria camelus*; larch—*Sirex gigas*; oak—*Sirex magus, Xiphydria longicollis, Cephus cynosbati*; beech—*Cephus cynosbati, Sirex magus, S. fuscicornis*; maple—*Sirex magus, Xiphydria longicollis*; elm—*Xiphydria* sp., *X. dromedarius*; birch—*Sirex magus, S. fuscicornis, Xiphydria longicollis, X. camelus*; alder—*Xiphydria camelus, Oryssus vespertilio*; poplar—*Sirex fuscicornis, Xiphydria dromedarius*; willow—*Xiphydria dromedarius, Cephus cynosbati*; pear—*Sirex magus, Xiphydria longicollis, Cephus abdominalis, C. compressus*; Rubus—*Cephus fumipennis*; and Spiræa—*Cephus major*.

A spraying mixture for cauliflower and cabbage worms, F. A. SIRRINE (*New York State Sta. Bul. 144, pp. 26–47, pls. 6*).—The use of a resin-lime mixture for the prevention of injury caused by the imported cabbage worm (*Pieris rapæ*) and the cabbage looper (*Plusia brassicæ*) is recommended. The formula for the insecticide is pulverized resin 5 lbs., concentrated lye 1 lb., fish oil 1 pt., and water 5 gal. This is to be made into a stock solution by placing the oil, resin, and 1 gal. of hot water in an iron kettle and heating it until the resin is softened, after which the concentrated lye is carefully added and the mixture thoroughly stirred. Four more gallons of hot water are added and the whole mass boiled until the mixture will unite with cold water, making a clear, amber colored liquid. When through boiling this mixture should make 5 gal. of the stock solution. When used the insecticide is prepared by combining 1 gal. of the stock solution, 16 gal. of water, 3 gal. milk of lime, and $\frac{1}{4}$ lb. Paris green. The water, resin, and milk of lime are combined, after which the Paris green is added. If the milk of lime should be added to the undiluted resin mixture, a heavy precipitate would be formed, which not only settles rapidly but interferes with spraying, as it clogs the nozzles.

This resin-lime mixture with Paris green was first tested in 1895, on elm trees for the elm-leaf beetle. Later it was used to spray ruta-bagas

which were badly infested with cabbage worms, and 3 days after treatment not a single living worm could be found. In 1896 and subsequently it was extensively tested on cabbage, cauliflower, and Brussels sprouts, and in every case when properly applied gave good results. During the fall and winter of 1897–98 it was tested on lettuce grown in forcing houses with good results, but the author does not recommend it for this purpose, as he thinks that the adults could be kept out of forcing houses by the use of mosquito netting to better advantage.

The experiments, which have been conducted on a considerable scale, indicate that the cost per acre of material and labor for 2 applications of this fungicide to cabbage or cauliflower would be about $2. Power spraying pumps can not be used for spraying cabbage or cauliflower, owing to the method of growth.

The life history of the 2 most serious insect pests to cabbage and cauliflower growing is given and detailed recommendations made for the application of the insecticides. The use of arsenites on such crops as these is attended with some danger, but the author states that if the directions given are carefully followed no ill effects will result. It is explicitly stated that this mixture should not be used on cabbage after the heads are two-thirds formed; that only skillful and intelligent laborers should be trusted with the application of it on cauliflowers, and that it should never be applied after the "flower" has commenced to form. For the heading varieties of lettuce it can be safely used until the plants are one-third grown; to other varieties it should never be applied.

Spraying, J. Craig (*Canada Expt. Farms Rpt. 1897, pp. 105–110*).—The apple orchards on the Central Experimental Farm were sprayed 4 times with Bordeaux mixture, and Paris green, and as a result of this work it was difficult at harvest time to find an imperfect specimen of fruit. Comparisons were made of using lysol and formalin in different strengths, the results indicating that lysol does not posesss qualities superior or equal to any of the present standard insecticides. With formalin some deterrent influence against the codling moth was noted, but it is hardly equal as an insecticide to some of the arsenites. A comparison was made of Bordeaux mixture containing Paris green and of Paris green in water. In reporting the experiments the author states that it will not pay a fruit grower to incur the expense involved in making a separate application of Paris green in view of the very doubtful benefits derived. Different formulas of Bordeaux mixture were compared, the one containing 6 lbs. copper sulphate and the other 4 lbs., and when applied to crab apple trees the weaker solution was found to be equally as efficient as the stronger, and did not injure the foliage. Experiments with arsenate of lead, which were continued from the previous year, indicate that this is a very effective remedy against the codling moth. Arsenate of lead in combination with Bordeaux mixture was sprayed on a number of crab apple trees with disastrous results, seeming to indicate that this combination is injurious to both foliage and fruit.

Experiments are reported in which different fungicides were employed

to prevent peach-leaf curl, peach and plum rot, and the orange rust of the quince. Different strengths of lysol, copper sulphate, and Bordeaux mixture were employed. The lysol was apparently without much effect. The trees which were sprayed with copper sulphate developed peach yellows, and were destroyed before harvest, while the Bordeaux mixture proved very efficient in preventing the leaf curl. Bordeaux mixture made from 3 lbs. copper sulphate and 3 lbs. of lime to 1 barrel of water is recommended for application on peach and plum trees.

During the summer of 1897 plum, cherry, and apple trees were severely attacked throughout Ontario and Quebec by aphides, nursery stock and young orchard trees suffering the most. Experiments were conducted with kerosene emulsion, tobacco water, tobacco water and lemon oil, quassia chips and whale-oil soap for the destruction of these insects, and it was found that where cheapness and efficiency is considered, tobacco water with whale-oil soap produced the best results. Tobacco water and lemon oil gave the most decisive results, but the addition of lemon oil increases the cost of the solution. In spraying for the destruction of these insects care must be exercised that the liquid shall reach the under surface of the leaves, and 2 or 3 applications at intervals of a few days should be made in order to destroy the different generations of the aphides.

Modern apiculture, A. L. CLÉMENT (*L'apiculture moderne. Paris: Librairie Lourousse, 1898, pp. 149, figs. 146, map 1*).—This is the fourth and revised edition of this work.

On the properties of cocoons of the various silkworm races of Japan, J. KAWARA (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 508–520*).—Notes are given of the physical properties of the cocoons of 12 Japanese, 1 Chinese, and 1 Italian race of silkworms.

Notes on the insects of the year, F. L. HARVEY (*Maine Sta. Rpt. 1897, pp. 173–178, pl. 1*).—Brief notes are given on a number of insects. Among the more common which are of economic importance are the zebra caterpillar (*Mamestra picta*), the potato-stalk borer (*Gortyna nitela*), the apple-tree tent caterpillar, forest tent caterpillar, beech-bud insect, brown-tail moth (*Euproctis chrysorrhœa*), and a timber beetle (*Dendroctonus rufipennis*).

The enemies of agriculture, C. RAMPON (*Les ennemis de l'agriculture. Paris and Nancy: Berger-Levrault & Cie., 1898, pp. 408, figs. 140*).—This work treats of injurious insects, fungus diseases, and injurious plants.

Insect and fungus diseases of fruit trees, and their remedies, ALLEN, BLUNNO, FROGGATT, and GUTHRIE (*Agr. Gaz. New South Wales, 9 (1898), No. 12, pp. 1426–1430, pl. 1*).—The life history and descriptive notes of 12 insect pests of the grapevine are given.

Injurious insects of the pear, V. MAYET (*Prog. Agr. et Vit. (ed. L'est), 20 (1899), No. 7, pp. 212–215*).—Notes are given on *Rhynchites bacchus* and *R. cæruleus conicus*, together with suggested methods for combating them.

Some notes on the entomology of Prunus, T. D. A. COCKERELL (*New Mexico Sta. Bul. 27, pp. 132–134*).—The important agency of wild bees in the cross fertilization of plums is pointed out. Attention is called to 3 insects infesting the wild cherry (*Prunus capollin*) in that region, namely, *Anthonomus (Tachypterus) quadrigibbus*, *Clisiocampa fragilis* var., and *Coleophora* sp., and the public is cautioned against their threatened introduction into orchards.

Combating cabbage pests, F. H. HALL and F. A. SIRRINE (*New York State Sta. Bul. 144, popular ed., pp. 8, pls. 2*).—This is a popular edition of Bulletin 144 of the station (E. S. R., 10, p. 869).

Insect injurious to rosaceous plants, E. LUCET (*Bul. Soc. Cent. Hort. Seine-Inférieure, 2. ser., 2 (1898), No. 3, pp. 321–359, pls. 2*).—The present paper treats principally of scarabids and curculios.

New genera and species of Australian Coleoptera, T. BLACKBURN (*Trans. Roy. Soc. South Australia, 22 (1898), No. 2, pp. 221–233*).

Notes on Australian Lepidoptera, A. J. TURNER (*Trans. Roy. Soc. South Australia, 22 (1898), No. 2, pp. 90–100, pl. 1*).

Descriptions of new Microlepidoptera, A. J. TURNER (*Trans. Roy. Soc. South Australia, 22 (1898), No. 2, pp. 200–214*).

The Hessian fly, W. G. JOHNSON (*Maryland Sta. Bul. 58, pp. 117–122, fig. 1*).—A brief popular account is given of the Hessian fly, its distribution throughout the State, and the best means for its suppression and control.

The ravages of Bombyx pini in Siedlec, Russian Poland (*Oesterr. Forst. u. Jagdw. Ztg., 17 (1899), No. 6, p. 43, figs. 2*).

Recent investigations of the European scale insects in comparison with the San José scale, FRANK (*Gartenflora, 48 (1899), No. 3, pp. 57–66*).

Experiments in combating Cochylis ambiguella, A. BATTAGLINI (*Bol. Ent. Agr. e Patol., 5 (1898), Nos. 1, 3, 4, 5; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 311, 312*).—Experiments with finely powered sulphur and 2 per cent rubin, and with preparation made of Bordeaux mixture and rubin, are reported. In addition to having valuable insecticidal properties, they also reduced the amount of mildew present.

Experiments in combating Cochylis ambiguella, A. BERLESE (*Bol. Ent. Agr. e Patol., 5 (1898), pp. 51–53; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, p. 312*).—The author reports favorably upon what is known as Martini's mixture for the suppression of this insect. This mixture is composed of Bordeaux mixture and rubin and has an important fungicidal action. Soap emulsions were found to be valueless in combating this insect.

FOODS—ANIMAL PRODUCTION.

Food and food adulterants, H. W. WILEY ET AL (*U. S. Dept. Agr., Division of Chemistry Bul. 13, pt. IX, pp. VII+1169–1374, pls. 7, figs. 4*).—This bulletin is an extended treatise on cereal grains and the products made from them. The composition of different grains and their various constituents are discussed on the basis of bulletins 9 and 45 of the division. The various constituents of different grains are spoken of in detail as well as methods of preparing cereals for food and the method of making and baking bread. The work of many investigators on the insoluble carbohydrates of wheat is cited, and investigations conducted by the Division of Chemistry are reported. Following are some of the chief results:

"As determined by the analysis of the osazones, only the pentoses, xylose, and arabinose result from the hydrolysis of the hemicellulose. This is, therefore, practically identical with the free or normal pentosans which the wheat contains.

"The preparation of cellulose from the fiber insoluble in dilute acid was found to be best effected by means of alkali and chlorin as described by Cross and Bevan. . . .

"The cellulose obtained as just mentioned, or by fusion of the fiber with strong alkali (Lange's method), contains furfuraldehyde-yielding bodies whose deportment toward reagents indicates the presence of penta-anhydrid, probably in combination with a part of the hexanhydrid or normal cellulose. When dissolved in sulphuric acid, diluted, and hydrolyzed, a small quantity of dextrose only was obtained as osazone.

"The property of dyeing in a solution of ferric chlorid and potassium ferricyanid is possessed in a marked degree by the wheat fiber, and the reaction has been found

useful in testing the purity of "cellulose" residues. In this respect, as in the formation of the lignone chlorid, the lignified tissue of wheat resembles that of jute, the typical lignocellulose.

"No notable amount of oxycellulose has been found in any of the preparations from the wheat fiber. . . .

"The digestibility of the components in a case where wheat bran had been fed alone was found to be: Starch, 100 per cent; free pentosans, 66.2 per cent; lignin and allied substances, 36.7 per cent; cellulose, 24.8 per cent.

"From the analyses given in this paper and the best available results of other experimenters, the proportions present in normal mature wheat, air-dried, are calculated as follows:

Average percentages of insoluble carbohydrates in air-dried wheat.

	Per cent.
Starch	54.0 to 59.0
Free pentosans	3.5 to 4.5
Lignin and its allies	2.0 to 2.5
Cellulose	1.6 to 2.1
Total insoluble carbohydrates	61.1 to 68.1

Investigations on the soluble carbohydrates are also quoted and work of the Division reported. The quantities of invert sugar, sucrose, and dextrin found are shown in the following table:

Invert sugar, sucrose, and dextrin or galactin in cereals and cereal products.

Name.	Invert sugar.	Sucrose.	Dextrin.
	Per cent.	*Per cent.*	*Per cent.*
Wheat	0.027	0.330	0.160
Rye	.068	.416	.220
Oats	.031	.173	.260
Barley	.017	.177	.140
Wheat flour	.014	.101	.190
Graham flour	.038	.382	.210
Buckwheat flour	.000	.060	.006
Self-raising wheat flours	.000	.056	.080
Miscellaneous wheat flours	.003	.098	.130
Common market wheat flours	.021	.288	.210
Bakers' and family flours	.027	.190	.220
Patent wheat flours	.002	.085	.200

The ash was determined in a large number of samples of cereals. Some of the results are given in the following table:

Composition of pure ash of cereals.

Kind of grain	Potassium oxid.	Sodium oxid.	Calcium oxid.	Magnesium oxid.	Ferric oxid.	Phosphoric acid.	Sulphuric acid.	Chlorin.	Silica.
Wheat:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Canada	24.03	9.55	3.50	13.24	0.52	46.87	0.01	0.00	2.28
Argentina	14.06	2.04	5.73	16.88	.57	58.38	.02	.00	2.32
Rye:									
Minnesota	27.60	4.64	5.56	11.73	5.23	41.81	.52	.58	2.45
Other parts of United States	43.20	2.83	5.29	16.54	.42	27.63	.87	.00	3.22
Barley:									
United States	24.15	6.42	2.44	8.23	.33	35.47	.22	.56	22.30
Canada	26.76	9.36	4.27	7.87	.35	24.63	.71	.47	20.69
Oats: United States	15.91	4.38	4.09	7.18	.20	24.34	.48	1.02	42.64
Maize: United States	33.92	7.72	3.18	17.99	.50	35.25	.44	.00	1.00
Rice: Polished Guatemala	22.45	8.89	5.64	9.80	.49	45.13	.50	.95	6.66
Buckwheat: United States	35.15	2.26	6.62	20.55	1.68	24.09	3.59	.67	5.54

The importance of the different mineral constituents in nutrition is discussed at considerable length.

Analyses are reported of a large number of samples of flour and of the various milling products of wheat, of patent, self-raising, gluten, and Indian-corn flour, rye, and buckwheat. The method of determining the heat of combustion of cereals is discussed at length, and a number of investigations reported comparing the values obtained by combustion of the constituents of cereals with the results obtained by calculation, using the ordinary factors. The following factors are proposed for the different carbohydrates and protein of cereals: Pentosans 3,800 calories per gram, cellulose 4,200 calories, sugar 3,950 calories, and protein 5,900 calories. Determinations of the oils of cereals gave the following values: Wheat oil 9,359 calories, rye oil 9,322 calories, Indian-corn oil 9,280 calories. The ether extracts of different cereals gave the following values per gram: Wheat 9,070 calories, oats 8,927 calories, barley 9,070, rye 9,196. The factor proposed for the calculation of the heat of combustion of fat of cereals is 9,300 calories per gram. On the basis of a number of actual determinations the heat of combustion, as calculated by these factors and as actually determined, is compared.

"While the variations in individual instances are considerable, the factors which have been adopted must be very nearly correct, inasmuch as the mean calculated calories differ very little from those determined by actual combustion. . . .

"In the light of the data here presented, we can with reason claim that the determination of the calorific power by combustion under pressure in oxygen is destined to be a valuable aid to the analyst in serving as a check upon the analytical data. We are further warranted in believing that whenever the calculated calories and the analytical data in hulled cereals and cereal products differ by as much as 100 from those obtained by combustion, the chemist will do well to repeat both the analysis and the combustion in order to discover the source of error. The calorimeter in this way becomes a valuable adjunct to the chemist in his work from a purely analytical point of view."

The average composition of different sorts of wheat and other flours is given, including entire wheat flour, self-raising flour, gluten flour, and flours made from corn, rye, and barley.

The carbohydrates in a number of flours are as follows:

Carbohydrates in flours.

	Sucrose.	Dextrin, galactin, and soluble starch.	Pentosans and reducing sugars.	Crude fiber.	Starch (proteid factor, 5.70).
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Patent flours	0.10	0.20	Trace.	0.20	75.60
Common market wheat flours	.25	.20	0.01	.30	75.80
Bakers' and family flours	.10	.15	Trace.	.25	75.65

A number of adulterants in flour, meal, and bread are described, together with methods of deduction. A large number of analyses were made of bread purchased in Washington, D. C., breakfast foods and similar products, biscuits, crackers, cookies, and similar goods. The average results for different classes of bread are given in the following table:

Average composition of breads purchased in the open market.

Class.		In the original substance.									Heat of combustion (calculated).	Heat of combustion (determined).
		Moisture.	Proteids (N × 6.25).	Proteids (N × 5.70).	Ether extract.	Carbohydrates excluding fiber. *a*	Crude fiber.	Ash.	Salt.	Digestible albuminoids.		
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*	*Calories.*
1	Vienna bread	38. 71	8. 87	8. 09	1. 06	53. 72	0. 62	1. 19	0. 57	89. 87	4, 435	4, 458
2	Homemade bread	33. 02	7. 94	7. 24	1. 95	56. 75	. 24	1. 05	. 56	53. 76	4, 467	4. 497
3	Graham bread	34. 80	8. 93	8. 15	2. 03	53. 40	1. 13	1. 59	. 69	86. 61	4, 473	4, 434
4	Rye bread	33. 42	8. 63	7. 88	. 66	56. 21	. 62	1. 84	1. 00	74. 06	4. 338	4, 395
5	"Quaker" bread	36. 16	7. 78	7. 10	1. 14	54. 53	. 26	1. 06	. 58	59. 27	4, 338	4, 395
6	Miscellaneous breads	34. 41	7. 60	6. 93	1. 48	56. 18	. 30	1. 00	. 49	56. 36	4, 429	4, 401

a Calculated on the assumption that protein = N × 5.70.

The average composition of the breakfast foods, etc., made from the various cereal grains is as follows:

Average composition of breakfast foods and similar products.

	In the original substance.							Heat of combustion (calculated).	Heat of combustion (determined).
	Moisture.	Proteids.	Ether extract.	Carbohydrates other than fiber.	Crude fiber.	Ash.	Digestible proteids.		
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Calories.*	*Calories.*
Shredded wheat biscuit	10. 57	12. 06	1. 03	71. 11	2. 58	2. 65	......	....	....
Indian corn breakfast foods (average of 6)	12. 33	7. 92	. 58	78. 51	. 67	. 66	24. 86	4, 385	4, 360
Wheat breakfast foods (average of 14)	10. 08	*a*12. 01 *b*10. 96	1. 80	*e*75. 62	1. 48	1. 55	62. 47	4. 462	4, 482
Oat breakfast foods	7. 66	*a*15. 32 *c*15. 48	7. 46	*f*67. 61	1. 20	1. 79	51. 09	4, 875	4. 671
Starch and tapioca	11. 29	*a* . 39	. 03	*g*88. 15	. 13	. 14	......	4, 193	4, 160
Noodles, spaghetti, and macaroni	9. 66	*a*12. 02	. 42	*g*77. 12	. 56	. 78	80. 53	4, 428	4. 342
Barley breakfast foods	10. 92	*a*7. 50 *d*6. 98	. 89	*h*80. 35	. 67	. 86	39. 20	4, 34[illegible]	4, 365
Miscellaneous	6. 41	12. 81	1. 05	*g*78. 68	. 99	1. 06	52. 04	4, 449	4. 460

a Estimated as N × 6.25.
b Estimated as N × 5.70.
c Estimated as N × 6.31.
d Estimated as N × 5.82.
e Estimated by difference, protein being taken as N × 5.70.
f Estimated by difference, protein being taken as N × 6.31.
g Estimated by difference, protein being taken as N × 6.25.
h Estimated by difference, protein being taken as N × 5.82.

The average composition of the biscuits or crackers, rolls, and cakes analyzed is shown in the following table:

Average composition of miscellaneous products.

	Moisture.	Proteids (N × 6.25).	Proteids (N × 5.70).	Ether extract.	Carbohydrates other than fiber and sugar (N × 5.70).	Sugar.	Fiber.	Ash.	Salt.	Digestible proteids.	Heat of combustion (calculated).	Heat of combustion (determined).
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Calories.*	*Calories.*
Biscuit or crackers (average of 48)	7.13	10.34	9.43	8.67	73.17	......	0.47	1.57	0.99	65.81	4,755	4,697
Rolls (average of 11)	27.98	8.20	7.48	3.41	59.82	......	.60	1.31	.69	68.89	4,538	4,481
Cake and similar goods (average of 61)	11.65	6.91	6.29	9.81	46.01	24.57	.50	1.17	.39	71.17	4,805	4,729

The analytical data in the bulletin are discussed in detail, and much American and foreign work on the topics treated is summarized.

Forage plants and fodders, F. T. SHUTT (*Canada Expt. Farms Rpt. 1897, pp. 146–151*).—The composition is reported of awnless brome grass (*Bromus inermis*) ready for cutting; awnless brome grass hay, cut when the seed was just formed; when the seed was ripe; the straw from awnless brome grass hay and chaff (containing some seeds) from awnless brome grass; storksbill or alfilaria (*Erodium cicutarium*), green material and air-dried hay; "heavy feed" and buckwheat bran. "Heavy feed" examined under the microscope was found to consist chiefly of ground wheat and oats, the bran forming approximately 25 per cent of the whole. Storksbill hay had the following percentage composition: Water 10.32, protein 23.12, ether extract 4.53, carbohydrates 30.70, crude fiber 10.97, and ash 20.36.

On the absorption of several kinds of fat in the intestinal tract of man, N. KIENZL (*Oesterr. Chem. Ztg., 1 (1898), No. 6, pp. 198–202*).—Experiments were made with a man 30 years old, weighing 78 kg., on the digestibility of butter, rendered butter, lard, oleomargarin, "margarin schmalz," and "margarin butter." "Margarin schmalz" is described as a mixture of oleomargarin with sesame and peanut oils, and margarin butter as a mixture of oleomargarin, sesame, and peanut oil with butter. The experiment was divided into periods of 2 days each. The feces were separated with charcoal. The butter and other fats used were analyzed and the fat in the feces determined. The results of the experiment are shown in the table below. In addition to the foods enumerated, soup and some vegetables were also consumed each day.

Digestibility of various fats by man.

Food per day.	Fat.			
	In food.	In feces.	Digested.	Coefficient of digestibility.
	Grams.	*Grams.*	*Grams.*	*Per cent.*
Period 1: Meat 243.5 gm., bread 425 gm., margarin butter 100 gm., and "margarin schmalz" 112.5 gm	201.8	8.8	193.0	95.64
Period 2: Meat 240.5 gm., bread 400 gm., butter 103.9 gm., and lard 138 gm	225.5	6.6	218.9	97.07
Period 3: Meat 247 gm., bread 400 gm., margarin butter 103 gm., and oleomargarin 86.9 gm	197.1	7.7	189.4	95.72
Period 4: Meat 250 gm., bread 343.5 gm., butter 130.4 gm., and rendered butter 72 gm	183.0	6.2	176.8	96.65

Although the differences in digestibility of the various sorts of fat are small, the author does not believe that they are entirely due to experimental errors. The butter and lard and the butter and rendered butter are regarded as slightly more digestible than the other fats. The superior quality of the oleomargarin and similar products used is noted. The article contains references to previous experiments along similar lines.

The theory of fat resorption, III, O. FRANK (*Ztschr. Biol.*, *36*, *No. 4*, *pp. 568–593*).—In continuation of previous work[1] the author reports a number of experiments with dogs. The principal conclusions were as follows: With the exception of stearic acid ester, ethyl esters of the higher fatty acids were consumed in large amounts by a dog. Before being resorbed they underwent cleavage in the small intestine. None was found in the chyle. From investigation it seems certain that a synthesis of fatty acids and glycerin to triglycerid takes place before fat is absorbed. In addition to the resorbed fats in the chyle, fatty material is also found which is derived from the intestine and intestinal juices. The secretion of such material is small—not greater than in the case of fasting.

Chemical composition of the carcasses of pigs, H. W. WILEY ET AL (*U. S. Dept. Agr.*, *Division of Chemistry Bul. 53*, *pp. 80*).—A detailed study was made of the chemical composition of the carcasses of Berkshire, Tamworth, Chester White, Poland China, Duroc Jersey, and Yorkshire pigs. There were 3 Duroc Jerseys and 1 of each of the other breeds. The carcasses were received from the Iowa Station, and this investigation supplements a feeding test at the station not yet reported, comparing the different breeds. In addition to the regular cuts, the skin, bones, marrow, spinal cord, tendons, and hoofs were analyzed, the determinations made being water, fat, proteids insoluble in hot water, gelatinoids, flesh bases, lecithin, and ash. The results are reported in detail for each cut of each pig. The table which follows shows the composition of some of the more important cuts from each breed.

[1] Arch. Physiol [Du Bois-Reymond], 1892, p. 497; 1894, p. 297.

Composition of fresh substance of flesh of different breeds of pigs.

No.	Breed of pigs.	Water.	Nitrogenous substances. Proteids insoluble in hot water.	Nitrogenous substances. Gelatinoids.	Nitrogenous substances. Flesh bases.	Nitrogenous substances. Total.	Fat.	Lecithin. *a*	Ash.	Total.
	American clear backs.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	Berkshire	32.27	7.00	0.50	0.91	8.41	57.69	0.15	0.51	99.03
2	Tamworth	29.13	5.75	.69	.91	7.35	61.76	.13	.43	98.80
3	Chester White	23.72	4.50	.44	.75	5.69	70.16	.12	.35	100.04
4	Poland China	26.13	5.13	.56	.81	6.50	66.33	*b* .21	.38	99.55
5	Duroc Jersey	20.75	3.94	.50	.84	5.28	73.25	.08	.29	99.65
6	Do	20.32	3.75	.44	.72	4.91	73.63	*c* .20	.29	99.35
7	Do	20.23	4.06	.56	.50	5.12	73.95	*c* .48	.29	100.07
8	Yorkshire	28.55	5.94	1.06	.62	7.62	62.53	*c* .32	.41	99.43
	American clear bellies.									
1	Berkshire	37.27	7.00	.56	1.22	8.78	51.93	.14	.55	98.67
2	Tamworth	33.69	7.00	.63	.91	8.54	56.52	.15	.47	99.37
3	Chester White	30.54	5.44	.63	1.03	7.10	60.73	.08	.42	98.87
4	Poland China	30.78	4.81	.63	1.19	6.63	60.69	.12	.43	98.65
5	Duroc Jersey	29.13	5.06	.56	1.00	6.62	62.83	.10	.42	99.10
6	Do	34.52	4.38	.56	.59	5.53	58.97	*c* .12	.22	99.36
7	Do	21.53	2.81	.38	.31	3.50	73.56	*c* .48	.21	99.28
8	Yorkshire	33.79	6.75	1.25	.66	8.66	56.22	*c* .25	.48	99.40
	Short-cut hams.									
1	Berkshire	60.29	14.00	.69	1.15	15.84	22.19	*c* .65	.96	99.93
2	Tamworth	57.93	13.00	.63	1.25	14.88	24.45	.22	.84	98.32
3	Chester White	53.15	11.13	.63	1.97	13.73	30.99	.35	.80	99.02
4	Poland China	54.78	10.69	.81	1.28	12.78	30.12	.23	.76	98.67
5	Duroc Jersey	50.45	8.38	1.00	.50	9.88	35.94	.03	.71	97.01
6	Do	37.26	17.38	1.25	1.69	20.32	39.10	.35	1.32	98.35
7	Do	44.26	9.56	.87	.81	11.24	43.38	*c* .45	.65	99.98
8	Yorkshire	59.14	11.50	.87	1.09	13.46	25.23	*c* .42	.74	98.99
	Spareribs.									
1	Berkshire	52.54	13.44	1.13	1.19	15.76	29.10	.35	1.00	98.75
2	Tamworth	49.20	11.56	1.31	1.40	14.27	33.88	.25	.93	98.53
3	Chester White	53.23	13.63	.87	1.65	16.15	27.93	.28	.92	98.51
4	Poland China	52.95	10.06	.63	3.09	13.78	29.55	.31	.95	97.54
5	Duroc Jersey	54.09	14.06	.81	1.53	16.40	26.90	.12	1.04	98.55
6	Do	49.84	13.63	1.13	1.09	15.85	31.95	.33	1.10	99.07
7	Do	53.20	14.56	1.13	1.09	16.78	27.51	*b* .83	1.01	99.33
8	Yorkshire	52.31	13.56	1.13	1.34	16.03	29.28	.33	1.05	99.00

a In extracted sample. *b* Calculated from averages of like cuts. *c* In residue and fat extract.

The average composition of the meat from all cuts of the dressed carcass, the bones, marrow, etc., is shown in the following table:

Average composition of carcasses of pigs.

	Water.	Nitrogenous substances. Proteids insoluble in hot water.	Nitrogenous substances. Gelatinoids.	Nitrogenous substances. Flesh bases.	Nitrogenous substances. Total.	Fat.	Lecithin.	Ash.	Total.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Meat from all cuts	35.85	7.20	0.72	0.96	8.88	53.51	0.23	0.54	98.99
Dressed carcass (with head, leaf lard, and kidneys removed)	36.43	8.12	1.10	1.14	10.46	49.67	.23	2.11	98.90
Bones	38.55	18.03	.79	1.14	19.95	14.01	.31	25.44	98.26
Marrow	14.57	2.10	.14	.06	2.29	81.13	.13	....	98.11
Skin	46.33	13.09	8.67	4.59	26.35	22.89	.19	.62	96.52
Spinal cord	48.27	5.61	.86	.29	6.77	41.21	1.54	.39	97.94
Tendons	59.05	23.97	4.35	1.10	29.41	11.15	.19	1.07	100.87
Hoofs	43.82	....	....	....	....	.67	55.85	.88	100.77

The relative proportion of the different parts of the carcass to the entire dressed animal, weighing on an average, 144.6 pounds (the head, leaf lard and kidneys being removed), was as follows: Meat (fat and lean), 88.62 per cent; bones (less marrow), 6.28 per cent; skin, 4.67 per cent; marrow, 0.12 per cent; spinal cord, 0.08 per cent; tendons, 0.16 per cent, and hoofs, 0.08 per cent.

The analytical data are discussed in detail.

"In regard to the details of the various constituents, it is seen that the Berkshire leads all the others in the percentage of water, namely, 13.10. The smallest percentage of water is in one of the Duroc Jerseys, namely, 30.31. The largest percentage of fat is found in a Duroc Jersey, namely, 57.68, and the smallest in the Berkshire, namely, 40.46. Of the total nitrogenous substances, the largest quantity is found in the Berkshire, namely, 13.02, and the smallest in a Duroc Jersey, namely, 8.96. It is evident that the meat of the Berkshire is better for the production of muscular strength, while that of the Duroc Jersey is best suited for the production of animal heat. These remarks are made without any expression of opinion concerning the type as a whole, but only on the data obtained from the 2 animals. The examination of a large number of typical animals of each of the breeds would be necessary to establish a definite rule of that kind. It is fair to presume, however, that the single animal is to a certain extent typical, and therefore represents to that extent racial characteristics."

Digestion experiments, J. M. BARTLETT (*Maine Sta. Rpt. 1897, pp. 141–158, pls. 1*).—Experiments to determine the digestibility of mixed silage from mature flint corn, sunflower heads, and horse beans; corn, sunflowers (whole plant), and horse beans; Sanford corn; hay, mostly timothy; corn meal, and skimmed milk, were made with 3 sheep. The usual methods were followed. The feeding periods were of 12 days' duration, the first 7 days being regarded as preliminary. The composition of the feeding stuffs used is reported. When corn meal or skimmed milk was fed with hay, the coefficients of digestibility were calculated, taking into account the values found when timothy hay was fed alone. In connection with the digestion experiments, the heat of combustion of the feeding stuffs and feces was determined with a bomb calorimeter. Taking into account the fuel value of the food, feces, and urea, the available fuel value of the rations was calculated. A summary of the digestion experiments follows:

Coefficients of digestibility.

	Dry matter.	Organic matter.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.	Available fuel value.
Silage from corn, sunflower heads, and horse beans:	Per ct.	Per cent.	Per ct.	Per ct.	Per cent.	Per ct.	Per ct.	Per ct.
Sheep I	67.6	70.0	64.9	77.6	74.0	63.7	41.2	65.5
Sheep II	63.5	65.6	60.4	74.7	70.8	56.5	40.9	61.4
Average	65.6	67.8	62.7	76.7	72.4	60.1	41.1	63.5
Silage from corn, sunflower (whole plant), and horse beans:								
Sheep I	63.6	67.8	56.6	76.0	72.4	62.8	20.5	63.3
Sheep II	67.3	70.8	59.3	72.2	75.0	67.8	30.6	66.9
Average	65.5	69.3	58.0	74.1	73.7	65.3	25.6	65.1

Coefficients of digestibility—Continued.

	Dry matter.	Organic matter.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.	Available fuel value.
	Per ct.	*Per cent.*	*Per ct.*	*Per ct.*	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*
Silage from Sanford corn:								
Sheep I	69.5	72.3	56.5	73.8	75.2	71.9	31.5	67.5
Sheep II	70.3	72.7	56.1	71.9	76.0	72.2	37.3	68.1
Average	69.9	72.5	56.3	72.9	75.6	72.1	34.4	67.8
Hay (mostly timothy):								
Sheep I	57.3	59.2	48.1	39.2	64.8	55.1	26.1	57.9
Sheep II	54.1	56.9	38.8	35.3	61.6	53.3	24.9	53.1
Sheep III	53.7	55.0	46.3	44.1	60.6	49.0	32.3	54.5
Average	55.0	57.0	44.4	38.9	62.3	52.5	27.8	55.2
Corn meal (fed with hay):								
Sheep I	97.1	98.0	77.8	93.8	98.6	....	56.1	....
Sheep II	93.7	93.9	78.5	94.1	95.8	....	78.8	....
Sheep III	89.2	89.9	79.7	89.7	95.1	....	50.9	....
Average	93.3	93.6	78.7	92.5	98.5	....	61.9	....
Skimmed milk (fed with hay):								
Sheep I	95.7	99.9	93.1	106.7	98.9	....	46.1	....
Sheep II	95.9	99.8	93.1	113.9	100.4	....	51.7	....
Sheep III	101.9	104.4	96.13	109.1	102.5	....	74.1	....
Corn meal (fed with skim milk and hay):								
Sheep I	92.3	92.4	83.4	97.8	96.2	....	76.4	....
Sheep II	91.4	91.6	78.9	97.6	96.1	....	20.5	....
Sheep III	85.1	88.0	68.3	98.9	93.5	....	52.1	....
Average	98.6	90.7	76.9	98.1	95.3	....	49.5	....

In several of the experiments the coefficients of digestibility of protein are reported, allowance being made for the metabolic nitrogen in the feces. After treatment by pepsin and hydrochloric acid, the coefficients of digestibility of hay (mostly timothy) was 62.7 per cent; corn meal fed with hay, 86.8 per cent; skim milk fed with hay, 96.4 per cent; corn meal fed with hay and skim milk, 85.7 per cent. After treatment of the feces with alcohol, ether, water, and limewater, the coefficients of the feeding stuffs enumerated was found to be 62.2 per cent, 90.5 per cent, 97.5 per cent, and 93.5 per cent. A table is given summarizing all the coefficients of digestibility obtained with sheep at the Maine Station.

Spontaneous combustion of feeding stuffs, F. HOFFMANN (*Ztschr. Spiritusind., 1897, Nos. 35, 39, 41, 42, 45, 47, 49, 50; abs. in Centbl. Agr. Chem., 27 (1898), No. 6, pp. 395, 396*).—The author made a number of experiments with clover hay. His principal conclusions follow: Heat is generated in clover hay, oxygen being taken up from the air and the organic matter transformed into carbon dioxid and water. The water moistens the hay, and the moistened material ferments owing to the presence of bacteria. The fermentation also produces carbon dioxid and water as well as small amounts of hydrocarbons, hydrogen, organic acids, enzyms, etc. Heat is also produced by fermentation. The fermentation is more rapid if the clover is moistened at the beginning. However, the water produced by oxidation of the material is sufficient

to start it. The fermentation of the hay causes a temperature of 56° C. At this temperature a second and more violent oxidation takes place, and the temperature rises to about 90°. Other processes then take place which char the material and cause a slow rise of temperature to 130°. When this temperature is reached the hay rapidly heats and the charring takes place rapidly. All these processes destroy at least half of the material present. Theoretically, the temperature may rise to 190°.

According to the tests made, clover hay will become ignited at 150–200°. Therefore, the temperature may rise sufficiently high to cause spontaneous combustion. Oxygen from the air is essential to combustion. Spontaneous combustion is indicated by the hay becoming darker in color until it is finally black, by a sooty odor, and by smoke irritating to the eyes. The ash of the burned hay has a characteristic grayish-white appearance and feels like sand. The burned hay is surrounded by a layer of charred but not burned material, which is a poor conductor of heat.

Live stock, A. MACKAY (*Canada Expt. Farms Rpt. 1897, pp. 398–400*).—A brief statement is made concerning the cattle, swine, and poultry kept during the year at the experimental farms for the Northwest Territories, and a feeding test to compare wheat chaff, cut oat sheaves, and cut brome grass is reported. The test was made with 2 lots of 4 steers each and one lot made up of 3 steers and 1 cow. Lot 1 was fed wheat chaff, lot 2 cut oat sheaves, and lot 3 cut brome hay. In addition all the animals were given 2 lbs. of silage to each pound of dry fodder and 6 lbs. of ground barley and wheat (2:1) per head daily. The test covered 4 months. During the last 2 months the grain ration was increased to 8 lbs. per head daily. Lot 1 made a total gain of 1,025 lbs., lot 2 of 910 lbs., and lot 3 of 1,015 lbs. The profits are briefly discussed.

Experiments in feeding steers, S. A. BEDFORD (*Canada Expt. Farms Rpt. 1897, pp. 328–330*).—Statistics are given of the condition of the college herd and a test of the comparative value of hay and oat sheaves made with 2 lots of 4 steers each is briefly reported. Lot 1 was fed *ad libitum* a ration consisting of 18 lbs. of native hay (*Elymus virginicus*), 30 lbs. cut turnips, 5 lbs. chopped barley, and 2 lbs. of chopped oats. Lot 2 was fed *ad libitum* a ration consisting of 18 lbs. cut oat sheaves, with the same amount of turnips, barley, and oats. The test covered 93 days. The financial statement is based on native hay and oat sheaves at $5 per ton, turnips at 5 cts. a bushel, chopped barley and oats at ½ ct. per pound each. The steers in lot 1 made a daily average gain of 1 lb. 8 oz. and lot 2, 1 lb. 5 oz. The profit on lot 1 was $55.42 and on lot 2, $50.37.

"From the above it would appear that the cultivated native hay is worth rather more per ton than oat sheaves for fattening purposes.

"The yield of hay from this grass varies greatly from year to year, depending on

the rainfall, but it averages somewhat less than the yield of oat sheaves, under the same conditions.

"This grass succeeds remarkably well on dry uplands, where an oat crop would give small returns. Its roots are also very useful in preventing the drifting of soil."

Experiments on the feeding of steers, W. SAUNDERS (*Canada Expt. Farms Rpt. 1897, pp. 75–79*).—A test was made with 3 lots of 4 steers. During a preliminary period of 1 month all were given a ration consisting of 50 lbs. corn silage, 25 lbs. of roots, 5 lbs. of cut hay, and 5 lbs. of cut straw. The test proper began December 15, 1897, and covered 16 weeks, being divided into 3 periods of 8, 4, and 4 weeks respectively. Throughout the test all the steers were given the same coarse fodder ration as during the preliminary period. During the first period lot 1 was fed no grain in addition. During the second period the steers were given 2 lbs. of a mixture of equal parts of peas, barley, oats, and bran per head daily. During the third period this was increased to 6 lbs. The steers in lot 2 were given 2 lbs. of the same mixture per head daily during the first period, 4 lbs. during the second, and 6 lbs. during the third period. The steers in lot 3 were fed 4 lbs. of the same grain mixture per head daily during the first period and 6 lbs. per head daily during the second and third periods. The financial statement is based on corn silage and roots at $2, hay at $8, and straw at $4 per ton. The grain mixture was valued at the rate of 1 cent per pound. The foods consumed and the gains made by the steers during each period are recorded in full. The animals weighed about 1,000 lbs. each at the beginning of the test. The average gain of the steers in lot 1 was 200.5 lbs.; lot 2, 194.5 lbs.; lot 3, 202.25 lbs.

"The results of the foregoing experiments appear to show that it is economical to withhold the feeding of grain, or to feed but little of it, during the first portion of the feeding period. The steers in lot 1 fed without grain for the first 8 weeks cost on an average 9.80 cts. per day for the whole period of 111 days; lot 2, 11.10 cts., and lot 3, 12.14 cts. per day. This shows an average cost of 1.30 cts. per day more for each animal in the second lot than for those in the first lot, and 2.34 cts. per day more for each steer in the third lot than for those in the first lot. This makes the average cost of feeding each animal in the second lot for the 111 days during which these tests were continued $1.44 more than for those in the first lot, while the average gain in weight at the close of the experiment was 6 lbs. more per head in the first lot than it was in the second. The steers comprising the third lot cost on an average $2.60 per animal more than those in the first lot, while the advantage in gain was only 1¾ lbs. per head."

Experiments in fattening swine, W. SAUNDERS (*Canada Expt. Farms Rpt. 1897, pp. 80–86*).—Tests are briefly reported in which shorts; ground barley; ground Indian corn; shorts, a mixture of ground barley and Indian corn; a mixture of ground peas, barley, oats, and shorts with skim milk; unground oats; unground barley; unground peas; unground Indian corn; and a mixture of unground oats, barley, and peas were fed to swine. The grain was soaked in cold water before feeding, and the pigs were given all they would eat up clean. With the unground grain 3 lbs. of skim milk per head daily was fed. In

every case the foods consumed and the gains made are recorded. No comparisons are made and no deductions are drawn.

The amount of unground grain which passed through the swine undigested was determined by collecting the manure for one day and separating the undigested grain. When 14 lbs. of oats was fed, 2 lbs. 6 oz. of undigested grain was recovered. When dry, this weighed at the rate of 22½ lbs. per bushel. A germination test was made and 11 per cent of the grain sprouted. When about 17 lbs. of barley was consumed, 2 lbs. 2 oz. was separated undigested, weighing at the rate of 35 lbs. per bushel when dry. This was also tested as to its germinating power, but none of the kernels sprouted. When about 17 lbs. of peas was fed, 2 oz. was separated undigested. When tested none of the peas sprouted. From about 11 lbs. of corn consumed, 8 oz. of undigested grain was obtained, weighing at the rate of 40.25 lbs. per bushel when dry. Eight per cent of this grain sprouted when tested. When about 11 lbs. of a mixture of unground oats, barley, and peas was consumed, 10 oz. was recovered undigested. One hundred kernels of the mixed grain was tested as to its germinating power. Only 2 kernels of oats sprouted.

Poultry, S. A. BEDFORD (*Canada Expt. Farms Rpt. 1897, pp. 331–334*).—Brief statements are made concerning the poultry kept at the Manitoba Station, and a comparative experiment on the fattening of 10 turkeys and 10 chickens is reported. The chickens were made up of 6 White Plymouth Rock cockerels and 4 Black Minorca cockerels. Five turkeys and 5 chickens (3 Plymouth Rocks and 2 Black Minorcas) were fed in pens. The remaining turkeys and chickens were not confined. The turkeys and chickens in pens were given all they would eat up clean of a mixture of wheat, oats, and barley 2:1:1. In the morning the grain was fed chopped and wet with milk and in the evening it was fed whole.

"The turkeys were apparently more fond of oats than either barley or wheat, and towards the latter portion of the fattening period the proportion of this grain was increased with benefit."

A little grain was given to the turkeys and chickens which were not confined in addition to the food which they could gather. The turkeys were fed from October 14 to November 25; the chickens from September 28 to November 26. The turkeys in pens weighed 32 lbs. 12 oz. at the beginning of the test and gained 20 lbs. 4 oz., consuming 6 lbs. grain per pound of gain. The turkeys running at large weighed 32.12 lbs. at the beginning of the test and gained 9 lbs. 4 oz. The food consumed and gains made are recorded for the 2 breeds of chickens. The chickens confined in pens weighed 20 lbs. 7 oz. at the beginning of the test and gained 11 lbs. and 2 oz., consuming a total of 57 lbs. of grain. The chickens running at large weighed 18 lbs. and 15 oz. at the beginning of the test and gained 4 lbs. 14 oz. The turkeys and chickens were killed and the shrinkage between the live and dead weights recorded.

"The penned fowl, both turkeys and chickens, when dressed, were much plumper and in every way more inviting than those which had been running at large, but the close confinement and heavy feeding appears to injure the chickens otherwise, the White Plymouth Rocks being badly 'off their feet,' while those running at large were quite healthy and active.

"Both turkeys and chickens made the largest increase during the first 3 weeks.

"After 6 weeks of close confinement chickens are probably kept at a loss.

"White Plymouth Rock chickens are better adapted for feeding in small pens than Black Minorcas.

"The White Plymouth Rocks were a better color and more attractive when dressed than the Black Minorcas.

"Penned turkeys shrunk 5 per cent less in dressing than those running at large.

"Chickens whether penned or running at large lost practically the same in dressing, viz, 34 per cent.

Adulteration of commercial and edible fats and oils, A. MÜNTZ, C. DURAND, and E. MILLAU (*Ann. Sci. Agron., 1898, II, No. 1, pp. 113–160; 2, pp. 161–186*).

The effect of fresh gluten upon old flour, BALLAND (*Jour. Pharm. et Chim., 6. ser., 9 (1898), pp. 52–55; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 1899, No. 1, p. 156*).—It is the gluten in old flour which causes it to spoil. By sifting the spoilt flour, the greater part of the material may be obtained which gives the flour its bad taste, smell, and high acidity. If fresh gluten is then added, and the flour sifted after about 14 days, a flour of improved smell, taste, and lower acidity is obtained. It is also more suitable for baking and makes better-flavored bread. These conclusions are based upon 8 experiments.

Diet in Italian hospitals, P. ALBERTONI (*Arch. Hyg., 34 (1899), No. 3, pp. 244–260*).—Tables are given which show the foods supplied in a number of Italian hospitals, together with their composition.

An experiment in adding sugar to the ration of soldiers, LEITENSTORFER (*Deut. Mil. Aerztl. Ztschr., 27 (1898), No. 7, pp. 305–314*).—Judging by the endurance manifested by the soldiers receiving it, the addition of sugar to the ration was beneficial.

Sugar in the ration of soldiers, J. DE PIETRA SANTA (*Jour. Hyg., 24 (1899), No. 1169, pp. 49–51*).—Some of the recent experiments on the use of sugar are briefly reviewed, and the use of sugar in the French army is discussed.

The calculation of rations on the basis of heat or energy, J. KÖNIG (*Milch Ztg., 27 (1898), No. 47, pp. 742–744*).—This is a brief summary of the methods of determining the heat of combustion and the application of such data to the compounding of rations for man and animals.

Nitrogenous feeding stuffs, C. S. PHELPS (*Connecticut Storrs Sta. Bul. 18, pp. 16*).—This is a condensation of an article entitled "Nitrogenous feeding stuffs and feeding formulas for dairy cows," by W. O. Atwater and C. S. Phelps (Connecticut Storrs Sta. Rpt. 1897, pp. 67–129; E. S. R., 10, p. 683).

Concerning sesame, A. HEBEBRANT (*Landw. Vers. Stat., 51 (1898), No. 1, pp. 45–81, pl. 1*).—The author describes the sesame plant, method of cultivation, gives the composition of the sesame seed, and discusses the manufacture of sesame cake and sesame oil. Considerable attention is devoted to a microscopical examination of sesame cake and the opinions of a number of investigators on the use of this cake are quoted. The article contains a bibliography.

Rape-seed cake, O. FÖRSTER (*Landw. Vers. Stat., 50 (1898), No. 5–6, pp. 371–447, fig. 1*).—The manufacture of rape-seed cake and meal is discussed, the characteristics of rape-seed and similar cakes from a botanical standpoint pointed out, and many investigations on the composition, impurities, digestibility, and feeding value of rape-seed cake quoted. A method of estimating the fat in rape-seed cake is described and determinations reported, which are compared with determinations by other observers.

Rape-seed cake and its impurities, B. GRAM (*Landw. Vers. Stat., 50 (1898), No. 5–6, pp. 449–481, pls. 12*).—The author describes the microscopical characteristics of rape-seed cake and its principal impurities.

What progress has been made in feeding meat meal? O. SCHELLENBERGER (*Fühling's Landw. Ztg., 47 (1898), No. 18, pp. 699–702: 19, pp. 717–721*).—A general article summing up some of the experiences with meat meal.

The consumption of oxygen and the amount of oxygen required by mammals, J. ROSENTHAL (*Arch. Physiol. [Du Bois-Reymond], 22 (1898), pp. 271–281; abs. in Zool. Centbl., 6 (1899), No. 3, p. 111*).—Experiments with animals are reported in which a respiration apparatus which combined the principles of Regnault-Reiset and Voit-Pettenkofer was used.

The fate of carbon monoxid in the animal body, F. WACHHOLTZ (*Arch. Physiol. [Pflüger], 74 (1899), No. 3–4, pp. 174–180*).

The relation of intestinal bacteria to nutrition, M. SCHOTTELIUS (*Arch. Hyg., 34 (1899), No. 3, pp. 210–243, figs. 3, dgm. 1*).—Tests were made with chickens hatched under conditions which rendered them free from intestinal bacteria. After hatching they were supplied with sterilized food and water and the experimental conditions were such that the intestinal tract was kept free from bacteria. After a few days the chickens did not thrive and at the end of 17 days were very weak. The tests were not continued until the chickens died, but, in the author's opinion, they could not have lived more than 2 or 3 days longer. The chickens were killed and culture experiments were made, which showed that they were free from bacteria. Chickens raised under the same general conditions, but with no precautions to prevent their acquiring intestinal bacteria, grew normally. The author points out ways in which the experiments could be improved, but considers that they show the necessity of intestinal bacteria.

White cattle: An inquiry into their origin and history, R. H. WALLACE (*Trans. Nat. Hist. Soc. Glasgow, n. ser., 5 (1897–98), No. 2, pp. 220–273, figs. 32, pls. 4*).—This is an extended study of the origin of the so-called white cattle of Great Britain.

Swine, A. S. BEDFORD (*Canada Expt. Farms Rpt. 1897, p. 331*).—Statistics are given of the pigs kept at the Manitoba Station farm.

Fattening swine, TANCRÉ (*Fühling's Landw. Ztg., 47 (1898), No. 20, pp. 770–774; 21, pp. 805–809*).—A general discussion of the subject.

Report of the poultry manager, A. G. GILBERT (*Canada Expt. Farms Rpt. 1897, pp. 231–245*).—Among other points, somewhat detailed statements are given of the rations fed to the poultry during the year and their cost, the eggs laid and the prices received for the eggs, and the number of eggs set and chickens hatched. The importance of avoiding overfeeding is insisted upon. Unsuccessful attempts to cross a tame gander with a wild goose and a wild gander with a tame goose are recorded. The wild goose laid 6 eggs, but none of them hatched.

The new poultry plant, G. M. GOWELL (*Maine Sta. Rpt. 1897, pp. 97–103, pl. 1*).—A description of the new station poultry house, with a brief outline of experiments undertaken.

DAIRY FARMING—DAIRYING.

Studies in milk secretion, drawn from officially authenticated tests of Holstein-Friesian cows, H. H. WING and L. ANDERSON (*New York Cornell Sta. Bul. 152, pp. 51–105*).—The results are given of 210 separate seven-day tests of 153 registered Holstein cows, representing 8 different herds. The tests were made at different times, beginning in 1894, for members of the Holstein-Friesian Association of America, under the supervision of authorized representatives of the station. Some cows were tested twice and one was tested 6 times. The data given include the yield of milk and butter fat, fat content as determined by the Babcock test, and the food consumed. The results are grouped according to the age of the cows, 74 tests being of two-year-olds, 38 of three-year-olds, 35 of four-year-olds, and 63 of cows 5

years old or over. "According to the scheme [of equivalent records] adopted by the Holstein-Friesian Association for the admission of cattle into the Advanced Registry, each two-year-old must have produced 7.2 lbs. of fat, three-year-old 8.8, four-year-old 10.4, and each cow 5 years old or older 12 lbs. of butter fat in 7 days."

The data are discussed from various standpoints and the following general summary is given:

"The largest total yield of fat among two, three, four year old, or full-aged cows is, under every age, accompanied by the highest percentage of fat found among cows of that age.

"The smallest yield of fat for each age of animal is accompanied in only one case by the lowest percentage of fat, and that among the two-year-olds.

"The largest yields of milk do not contain the lowest percentages of fat, nor do the smallest yields of milk contain the highest percentages of fat.

"The stall-fed cows average higher in total yield of milk and fat and in percentage of fat than the cows at pasture.

"Equal quantities of the same kinds of food or similar quantities of different kinds of food produce widely varying amounts of milk and butter in different animals.

"To produce the same or similar amounts of milk and butter different animals require widely varying amounts of food.

"Cows, although of the same breed and raised in the same herd, vary greatly in their power to make an economic use of food.

"The cost of production is greatest among two-year-olds, and decreases gradually as the age increases up to 4 years, after which there is little if any variation.

"Within a period of 90 days from calving there is but little average variation in the percentage of fat among the different ages, except that the average of all the tests made at 31 to 60 days from calving is lower than for any other period.

"There is a slight variation in the average percentage of fat between two, three, and four year olds, and full-aged cows.

"The highest percentages of fat usually follow the shortest period between milkings. The lowest percentages of fat usually follow the longest period between milkings. Where the cows are milked at equal intervals the highest percentages occur most often at or near the noon hour, and the lowest percentages about equally often at morning and night, with a much larger number at midnight than at noon.

"The average range of variation during 7 days between the highest and lowest percentages of fat for individual animals is greater among four-year-olds and full-aged cows than among the younger animals.

"Neither the cows which show very great variation during 7 days in the percentages of fat nor those which show slight variation are abnormal animals, since their total product of milk and fat is near the average for their class.

"Cows which have been once tested and forced to their greatest capacity for a week rarely reach the same height of production again during the same period of lactation, even though the circumstances be otherwise most favorable, but frequently have made increased records in succeeding periods of lactation.

"There is an increase of only 7.5 per cent of milk and 7.7 per cent in fat of full-aged cows over four-year-olds, which shows that, on an average, cows have very nearly reached their largest production between the ages of 4 and 5.

"The 'equivalent record' plan is supported by the records of individual cows which have been tested at various times from 2 to 5 years of age, but not by the average records of all the cows of the different ages."

Butter investigations, H. KREIS (*Verhandl. Naturf. Forsch. Gesell. Basel, 12 (1898), No. 1, pp. 108-125*).—The author reviews, at considerable length, the principal literature on the volatile fatty acids of butter and the methods for their determination, and reports an investigation

conducted under his supervision. The plan of investigation included the examination of samples of butter from large dairies each week during the year by 6 Canton chemists, but in fact examinations were made much less frequently. The maximum and minimum results for all except the author's work were as follows: Specific gravity, 0.866–0.869; volatile fatty acids (Reichert-Meissl number), 26.6–33.7; saponification equivalent, 224–235.8, and index of refraction, 41–44.

The author made a systematic study, covering one year, of the butter produced by a herd near Basel, the maximum and minimum results of which are as follows:

Variation in butter from a herd during one year.

Month.	Volatile fatty acids.	Saponification number.[a]	Index of refraction.	Month.	Volatile fatty acids.	Index of refraction.
1896.				1897.		
November	27.0–31.5	223.2–233.2	42.8–45.5	May	21.9–22.7	44.5–46.0
December	27.5–29.2	222.7–224.5	44.0–45.5	June	18.5–21.6	44.5–46.0
				July	19.0–19.5	45.2–46.2
1897.				August	18.2–23.6	44.2–46.8
January	23.5–26.2	218.6–228.2	43.7–45.5	September	20.7–22.8	46.1–46.6
February	23.7–25.6	222.0–227.1	43.7–45.0	October	25.1–27.2	45.1 45.9
March	22.8–25.5	....	44.0–45.2	November	22.6–26.3	43.9–46.1
April	20.9–23.7	216.9–221.7	44.6–47.0			

[a] As the index of refraction rose and fell with the volatile fatty acids, it was not determined after April.

The herd included fresh milch cows in varying number throughout the year. The low volatile fatty acids found in August were checked by a trial in which the author himself made butter from the milk drawn in his presence.

The author is inclined to believe that the time of year is not without effect on the composition of the butter. The results presented show the danger of condemning butter as adulterated on the basis of the volatile fatty acids. In the case of fresh butter the author recommends microscopic examination, and in the case of other butter he suggests that where possible a sample of milk from the dairy from which the butter emanated should be made into butter and examined.

Milk supplies of Pennsylvania, M. E. McDonnell (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 561–597*).—In addition to a general discussion of the characteristics of bacteria, the contamination of milk by disease germs, and the inspection and handling of milk, including protection from infection, pasteurization, use of preservatives, aeration, cooling, bottling, etc., the author presents a detailed report upon the examination of 352 samples of milk collected in 11 cities in the State. The data are tabulated and show the percentages of fat and total solids, specific gravity, acidity, total number of bacteria, and the number of liquefying bacteria per cubic centimeter, temperature on days of collection, and descriptive notes.

"The Pennsylvania supplies were studied at the hottest season of the year, and the number of organisms found is probably greater than it would be at any other time. The average number found in all of the milk examined, which included all

classes of milk, was over 5,500,000 per cubic centimeter. Ten samples contained 40,000,000 or more per cubic centimeter, and 10 others contained between 20,000,000 and 10,000,000 per cubic centimeter. These large numbers in a few samples make the total average very much higher than it should be. The worst samples were usually found at restaurants or with small retail dealers, so that such milk reaches fewer persons than that from the better supplies. Seventy-seven samples, 28 per cent of the samples tested, contained less than 100,000 bacteria per cubic centimeter. About 34 per cent contained less than 500,000 per cubic centimeter, and 121 samples, corresponding to about 45 per cent, contained less than 1,000,000 per cubic centimeter. . . .

"Of 312 samples tested for fat, 61 (18.7 per cent) were found to contain less than 3 per cent; 11 of these were below 2.75 per cent, 22 below 2.3 per cent, 12 below 2.25, and 7 below 2 per cent. Of 329 total solids determined 190 were below 12.9 per cent, 72 less than 11.5 per cent, and 37 less than 11 per cent. The specific gravity of 18 out of 329 samples was below 1.029. . . . The restaurant milk, as a class, was badly adulterated, the average per cent of total solids in all of the samples examined from this source (29) being only 11.33 per cent, and 13 of the samples were below 3 per cent fat and 11.5 per cent total solids. . . .

"Fifteen per cent of the samples examined were undoubtedly watered or skimmed."

Tuberculosis and milk supply, M. P. RAVENEL (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 495–507*).—The author cites evidence bearing on the question of hereditary transmission of tuberculosis and on infection by means of tuberculous milk, and gives the data and conclusions of experiments in which guinea pigs were each subjected to an intraperitoneal injection of 10 cc. of milk from cows reacting to tuberculin and showing physical signs of tuberculosis. In summarizing 3 series of experiments, the author says that "15.4 per cent of the animals became tuberculous from the single dose of milk." In a later series of experiments animals were inoculated with sterilized and unsterilized milk but none in either lot developed tuberculosis.

"From these and other like experiments it is fair to conclude that the number of bacilli in the milk of tuberculous animals varies from day to day, although it is possible that in taking 10 cc. from the whole mass of milk, we may have missed bacilli which were few in numbers. Additional evidence has also been given to show that the bacillus of tuberculosis may pass into the milk of cows having general tuberculosis, but whose udders are perfectly healthy, so far as the most careful examination by competent veterinarians can show. . . . Milk from suspected cattle should be carefully sterilized before using, and especially should not be given to infants and invalids. The inspections of the animals should be at intervals frequent enough to keep the disease from gaining headway before being discovered."

Tubercle bacilli in butter, LYDIA RABINOWITSCH (*Deut. Med. Wchnschr., 25 (1899), No. 1, p. 5; abs. in Centbl. Bakt. u. Par., 1. Abt., 25 (1899), No. 2–3, p. 77; Science, n. ser., 9 (1898), No. 215, p. 232*).—The author, whose previous work on this subject was published in 1897, has recently conducted further experiments in Berlin, examining the product of 14 dairy stores. Of these, 13 showed no trace of true living tubercle bacilli, but in many instances pseudo-tuberculous bacilli were found. The product from one store was found to contain tubercle bacilli; and during June and July the butter from this store was examined and 70 per cent of it found to contain living tubercle bacilli. Animals injected with the pseudo-tuberculous bacilli died of peritonitis.

The question whether they are harmful to human beings will be a matter for further investigation.

Pasteurization as applied to butter making, E. H. FARRINGTON and H. L. RUSSELL (*Wisconsin Sta. Bul. 69, pp. 10, figs. 3*).—The bulletin gives briefly the history of the use of pure cultures in butter making and describes a series of experiments, extending from February to August, which were made at the creamery of the Wisconsin Dairy School. Where pasteurization was practiced, the milk and not the cream was pasteurized. In 74 trials the milk was divided, a part being pasteurized, while the rest was used in the ordinary way. In addition to this the entire quantity of milk was pasteurized on certain days and on other days was used without pasteurizing. There were 110 cases of this kind. The unpasteurized milk was heated to about 85° for separating, while the pasteurized milk was heated to 155° F. in a Reid continuous pasteurizer. The cream was nearly always ripened with a starter made from the Boston butter culture, a pure culture of *Micrococcus butyri aromafaciens*. The other operations were similar to the ordinary methods of creamery butter making. The butter was scored twice by a butter expert in Chicago, the first time within 2 weeks after making. The second scoring for flavor was made several weeks later.

The culture starter was always found to be free from all foreign organisms, and it was demonstrated that practically sterile skim milk for the purpose of propagating the starter could be easily obtained in general creamery practice.

As to the efficiency of the sterilizer used, 13 samples of milk before heating showed an average of 32,000,000 bacteria per cubic centimeter, while the average of 16 samples after pasteurizing showed 1,800,000 bacteria, or a reduction of 94 per cent. As compared with an intermittent pasteurizer, the number of germs in the pasteurized milk is much larger.

The skim milk from the pasteurized milk kept from 12 to 24 hours longer than that from the unpasteurized milk, and in some cases was sweet after 48 hours.

The data for the butter making on 4 days in each month are tabulated, together with the scores of the butter made from pasteurized and unpasteurized milk, the scoring as affected by the size of the package, maximum, minimum and average composition of the butter from pasteurized and unpasteurized milk, efficiency of creaming milk heated to 85° and 155° F., and the churning record for the pasteurized and unpasteurized butter during the hot weather.

"A comparison of the flavor scores of 102 churnings of fresh unpasteurized butter with those of 75 of pasteurized butter shows the average score of each to be very nearly the same (40.69 unpasteurized, 40.63 pasteurized) on a basis of 45 as perfect flavor, but 5 per cent more of the unpasteurized than the pasteurized butter scored 42 points or better.

"The difference in the fresh scores is so slight that it is impossible from these scores to conclude that one system produces higher flavor than the other. The

scorer, however, claimed to be able to detect the pasteurized butter by its 'sweet,' 'curdy,' 'flat' taste, but did not materially reduce his score on this account. This conclusion is of material consequence, as it is usually claimed that as high a flavor cannot be secured in pasteurized butter as in that made in the ordinary way.

"Dividing the work into monthly periods (February to August), it can not be said that pasteurizing affects the quality of the butter more at one period than another.

"A comparison of the scores of 26 packages of butter, 8 lbs. and 60 lbs., from the same churning shows that the size of the package exerts an appreciable effect on the scorer's judgment of the butter flavor, the larger package scoring $\frac{1}{2}$ to 2 points higher than the smaller. On 'grain,' however, the size of package exerts no effect on the score. The importance of this deduction we believe to be considerable. Care should be taken, particularly in experimental work, to see that size of package is uniform throughout so as to eliminate this disturbing factor.

"The butter made from pasteurized milk was scored considerably lower on 'grain or body' than that made from unpasteurized milk. The pasteurizing process injures the 'grain and body' of the butter (according to American (Chicago) standards), as 62 per cent of the unpasteurized butter scored over 29 points on grain, while only 25 per cent of the pasteurized butter was given this score. This conclusion might be altered if butter had been sent to markets that are in the habit of using pasteurized goods.

"In our experiments both pasteurized and unpasteurized butter were quite uniform in quality, a slight difference existing in favor of the pasteurized goods.

"Pasteurizing the milk increased the keeping quality of the butter when stored for 2 to 4 weeks at butter cellar temperature, 50 to 60° F.

"Analyses of 14 samples of pasteurized and 19 of unpasteurized butter show but very little difference in the chemical composition. The average per cent of water in the pasteurized butter was 13.11 and in the unpasteurized 13.62.

"Heating the milk to 155° F. increases the skimming capacity of the separator, *i. e.*, more milk can be satisfactorily skimmed per hour at this temperature than at 85° F., provided the milk is heated by passing it over a hot surface. If heated to this high temperature by forcing steam into it, the skimming is unsatisfactory.

"More sediment accumulates in the separator bowl when the milk is skimmed at 155° F. than at 85° F. This is much more noticeable in ripe or tainted (sour) milk than in pure, sweet milk.

"A richer buttermilk was obtained from the pasteurized than from the unpasteurized churnings in hot weather, when the pasteurized cream, as a rule, was not so easily and thoroughly cooled as the unpasteurized. At other seasons when both churnings were made at about the same temperature there was not much difference in the amount of fat left in the 2 buttermilks.

"The yield of pasteurized butter in our experiments was on the average a little less than from unpasteurized butter. . . .

"The slight advantage as to keeping quality would in all probability be offset by the injury which it gives the grain as judged by American standards, and when we take into consideration the extra labor and expense involved in the process it is hardly to be expected that the system would yield increased returns over the ordinary method.

"In conclusion, we would say that according to the present demands of the American market, its introduction into creameries that already make a good product would hardly be justified."

The necessity for a butter standard, F. A. GENTH, jr. (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 519–560*).—This consists essentially of descriptions and tabulated analyses of 100 samples of butter collected in Philadelphia and vicinity. The work was undertaken to furnish

data for determining a standard of percentages of fat, water, curd, and salt for butters in the State. The following table shows the average composition of the samples of each grade:

Average analysis of different grades of butter obtained in the Philadelphia market.

	No. of samples.	Water.	Butter fat.	Curd.	Salt, etc.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
High-priced butter	20	11.56	85.29	1.10	2.05
Medium-priced dairy butter	33	9.54	86.69	1.36	2.41
Cheap dairy butter	2	11.31	84.37	2.22	2.10
Boiled or process butter	22	11.29	84.40	1.90	2.42
Miscellaneous butters	23	11.23	85.30	1.75	1.71

Of the 78 samples of unmelted butter examined only 1 contained less than 80 per cent of fat, and excluding 3 other samples on the ground of faulty manufacture—

"There remain only 3 samples of inferior quality which do not reach an 83 per cent butter-fat standard, to which any dairyman can easily bring his butter.

"The percentage of water, according to the results obtained, should not exceed 14 per cent at the very most, the standard adopted by Oregon.

"As to curd, over two-thirds contain less than 1.5 per cent, and less than 8 per cent of the total number of samples contain over 3 per cent. Of these, 2 are among those low in fats. Eight of the 11 samples, containing between 2 and 3 per cent, are under 2.5 per cent, leaving only 9 samples out of the whole lot over that figure, below which the curd in all butters should be reduced. The percentage of salt is about right when kept below 3 per cent."

Boiled or process butter, T. J. EDGE (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 175–178*).—Average analyses are given of different grades of butter obtained in the Philadelphia market including "boiled" or "new process" butter. These all show a content of butter fat above 80 per cent, which the author thinks is a fair standard for both the manufacturer and consumer. "Boiled" butter is described as being made from rancid and low-grade butter by a patent process in which the butter is reduced to its original oil, treated with alkali, freed from volatile oils, and churned with sour milk. From the standpoint of chemical analysis it can not be considered adulterated.

Feed and care of the dairy cow, H. M. COTTRELL, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 81, pp. 38, figs. 2*).—This consists of a popular discussion of various topics connected with the feeding and care of dairy cows, in which are given results of tests made to show the importance of clean milking and observations on the effect upon the fat content of milk of excitement of cows caused by shipping. The composition and value of various feeding stuffs are considered, and 100 rations are suggested.

In tests with 5 cows, the milk showed a gradual increase in the percentage of fat from the beginning to the end of the milking, with the exception of the last 2 pints drawn from each cow, which showed a sudden increase of 1 to 3 per cent. The average fat content for the 5 cows was 0.94 per cent for the first pint drawn and 6.84 per cent for the last.

The percentage of fat was determined in consecutive milkings for each of 5 cows immediately after their being shipped 100 miles on the cars. The data given show

irregular fluctuations in the fat content, continuing in one case to the ninth milking. The total yield of milk was much reduced.

Herd records, G. M. GOWELL (*Maine Sta. Rpt. 1897, pp. 192–200*).—This is a monthly record of 11 cows for 1897. The tabulated data include the yield of milk and butter, the kind and quantity of food, and a statement of cost of food per pound of milk and butter produced for each cow.

Effect of age of the cow on the yield and quality of milk (*Milch Ztg., 27 (1898), No. 53, p. 841*).—The milking trials made in Algau since 1894 are said to indicate in general that the yield of milk and fat increases up to and including the fifth calving, after which it gradually decreases, although there are exceptions in the case of individual cows. The milk is richest in fat after the third and fourth calvings.

The dairy markets of Pennsylvania, H. HAYWARD (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 598–617*).—This treats in a popular manner of the production and marketing of milk, butter, and cheese in Pennsylvania. The author discusses boards of trade in their relation to dairying, and quotes the constitution and by-laws of the Elgin board of trade.

Dairying (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 247–282*).—This contains 11 papers read at farmers' institutes in Pennsylvania during 1896–97, treating in a popular manner of various subjects connected with dairying.

Milk testing on a large scale by the Nahm method (*Milch Ztg., 28 (1889), No. 1, pp. 5, 6, figs. 3*).—Slight modifications of the apparatus used in this method (E. S. R., 6, p. 474), with an arrangement for making a number of tests at the same time.

Dairy and milk inspection, C. A. CAREY (*Alabama College Sta. Bul. 97, pp. 211–258*).—This is a popular bulletin treating of the testing of dairy herds for tuberculosis, the feeding and care of cows, the composition and analysis of milk, milk adulteration, bacteria and yeasts in milk, including pathogenic germs, pasteurization, disinfection of barns and dairy houses, the milk ordinance of Montgomery, Alabama, and a bibliography of works consulted in the preparation of the bulletin.

Testing dairy products by the Babcock test, J. M. BARTLETT (*Maine Sta. Rpt. 1897, pp. 61–96, figs. 8*).—This is largely a compilation treating of the subject in a popular manner. The apparatus required is figured and described, and detailed directions are given for sampling and testing milk, skim milk, buttermilk, whey, cream, butter, cheese, and condensed milk, special attention being given to sampling, weighing, and testing cream. A balance specially designed for weighing cream samples is described. The use of the lactometer and fat test in the detection of adulterated milk is discussed.

Tilsiter cheese and its manufacture, R. EICHLOFF (*Milch Ztg., 28 (1899), No. 4, pp. 52, 53*).—Describes the method employed in factories in West Prussia.

Cheese poison, R. C. KEDZIE (*Amer. Cheesemaker, 13 (1899), No. 156, pp. 2, 3*).—A popular explanation of the changes in milk and dairy products in general.

VETERINARY SCIENCE AND PRACTICE.

Report of the State veterinarian, L. PEARSON (*Pennsylvania Dept. Agr. Bul. 31, pp. 119–150*).—The report includes detailed statements of the work of the department during the year.

"The number of cattle tested up to June 1, 1897, was 9,108; the number of these that were found to be tuberculous and condemned was 1,839. The percentage of tuberculosis, therefore, was 20.39. Since June 1, 4,887 cattle have been tested with tuberculin, and of these 671 were found to be tuberculous and killed, equivalent to 13.73 per cent. Considering the manner in which the herds to be tested are selected and the wide distribution of the work, covering practically all parts of the State, it would seem fair to assume from this showing that many of the most thoroughly infested herds have been discovered and disposed of, and that the percentage of

tuberculosis among cattle at large is being steadily and rapidly reduced. This is indeed an encouraging condition, and I believe that it justifies the plan that has been adopted for meeting this disease."

The author discusses symptoms, methods of treatment, and prevention of rabies, glanders, hog cholera, abnormal (depraved) appetite of cattle, blackleg, tuberculosis, infectious abortion of cattle, catarrhal or broncho-pneumonia of cattle, and anthrax. Some of the more important deductions follow.

Reports from different parts of the State indicate that rabies is more prevalent than was suspected. The fact that infected dogs may spread the disease is recognized and preventive measures are suggested.

The author believes that by continued vigilance in destroying glandered horses and disinfecting the places occupied by them the disease may be stamped out. The value of mallein in diagnosing difficult cases of glanders is pointed out.

Vaccination for blackleg "has been practiced on a few infected farms in Pennsylvania during the past year with very encouraging results. No injury has resulted from the treatment, and thus far no cases have developed among the animals protected."

Attention is drawn to the fact that no injuries have been reported due to the use of tuberculin as a test for tuberculosis. The author notes that many investigations on methods of dealing with this disease are needed, and that the Department has experiments in progress which it is hoped will throw light on some of the obscure features of the tuberculosis question.

The importance of the satisfactory disposal of carcasses of animals affected with anthrax is insisted upon. Burning is recommended, and when this is not possible the carcass should be covered with lime and deeply buried in some locality where there is no danger of contaminating streams. The premises where the animal died should be thoroughly disinfected.

"Whenever anthrax appears it is important to so dispose of the carcasses of its victims that the soil may not become contaminated with its germs. This is best accomplished by burning the carcasses without opening them, because wherever a drop of blood falls the seeds of the disease may become established. If possible, the carcass should be burned on the spot where the animal dies. If this can not be done, on account of the surroundings, the carcass should be loaded onto a stone boat and dragged to a suitable place, and there thrown upon a loose pile of wood and cremated. If burning is not possible, the next best method of disposing of these carcasses is to bury them deeply away from water courses (where they would drain into a stream and might be washed out) and covered well with lime before the earth is thrown over them. Such graves should be so deep that there will be no danger of future accidental disinterment. If the animal dies in the stable, the premises occupied by it should be cleaned in the most thorough manner and disinfected by a thorough washing and saturation with a solution of bichlorid of mercury (corrosive sublimate) 1 part to 1,000 parts of water. As this solution is poisonous it must be used with care. The germs of anthrax prefer low moist soils and remain alive longest in such places. The infection of the soil of a given region with the germs of anthrax is a serious matter, and endangers the live stock for a considerable period thereafter."

Outbreaks of anthrax among the employees in tanneries in Pennsylvania and among cattle in the neighborhoods are described in considerable detail.

"These two outbreaks illustrate one of the important ways in which anthrax is carried long distances. Unfortunately, there appears to be no simple way by which we can protect ourselves from the danger resulting from the use of such infected hides. No method has yet been discovered for the safe, efficient, and economical disinfection of hides, and although attempts have been made upon the part of the Federal Government to plan and enforce such disinfections in the case of hides from suspected sources, they appear to have been evaded in a few cases. It seems that in some partly civilized countries the hides are removed from animals that die of anthrax and are exported. There is a provision against the importation of hides from districts where anthrax is known to exist, but as the hides do not always come directly from such districts the regulation does not fully prevent their importation. It has been shown by Griglio, an Italian investigator, that the spores of the anthrax bacillus are even more resistant than is usually supposed, and that the usual, so-called, disinfection to which wool and hair and hides are sometimes submitted is futile. He has found that the salting of hides and steeping of the skins in brine does not destroy the spore, nor does soaking of the dried hides in milk of lime, nor prolonged drying; and other observers have noticed that treatment even with arsenic does not disinfect the skins. One reason for this may lie in the fact that spores exist not only on the surface of the skin, but in the deeper parts, whither they are carried in the circulation.

"With continued careful oversight of the localities in which anthrax has developed, the proper disposition of all suspected carcasses and a judicious use of vaccine, there is every reason to believe that the disease can not only be kept within present bounds but that it will in time be suppressed."

The other diseases enumerated are treated of in less detail.

Effects of tuberculin on tuberculous cows, F. L. RUSSELL (*Maine Sta. Rpt. 1897, pp. 159–166, pl. 1*).—In a previous publication (E. S. R., 9, p. 891) a partial report was made of the progress of tuberculosis in a herd of 10 cows, which had given reaction to the tuberculin test. During the year the investigation was continued. The cows were quarantined in a light and well-ventilated stable and well fed and cared for. In summer they had the run of a small pasture, and in winter were allowed the run of a sunny yard when the weather permitted. The attempt was made to keep the animals in as healthy condition as possible without resorting to any unusual means. From time to time the cows were tested with tuberculin and were finally destroyed, *post-mortem* examinations being made.

In the author's opinion the investigation shows that—

"Kept under exceptionally good conditions as these cattle were, 5 of them kept the disease in check, so that it made practically no advancement. In the case of 3 others but little advance was made, while in 2 cases the disease had nearly reached a fatal termination when the animals were killed. On the whole, we can not see that the exceptionally good care that these animals received had any effect on the progress of the disease. It may have retarded the progress of the disease, but if so, the fact is not sufficiently clear to lend much weight to the argument that tuberculosis can be successfully controlled by simply maintaining animals under good hygienic conditions. Twenty per cent of deaths is probably as high a percentage as one could reasonably expect among ordinary tuberculosis herds kept under poor or only fair hygienic conditions if, to begin with, all cases that presented any physical symptoms of disease were removed."

Four pigs and 15 calves were fed milk from the tuberculous cows; the pigs being given some meal and the calves a little hay in addition. The pigs were killed when they weighed about 175 pounds, and the calves when from 6 to 8 weeks old. One of the pigs and 2 of the calves were found to be tuberculous.

Parturient apoplexy and its modern methods of treatment, POEPPEL (*Milch Ztg., 27 (1898) No. 40, pp. 628, 629*).—In this article, which is a reprint from another journal, the author summarizes the opinions regarding causes and treatment of parturient apoplexy (*Eclampsia puerperalis*) in milch cows and reports results of recent investigations. According to a Danish veterinarian, Schmidt von Kolding, the disease is caused by decomposition of the secreting cells in the udder when the milk secretion begins after calving, a leukomaine being formed from the cholesterin bodies, this leukomaine being the direct cause of the disease. The method of treatment proposed is injection into the udder of a solution of 10 gm. of potassium iodid in a liter of freshly boiled water. The solution should be inserted at a temperature of 40 to 42° C. A milk catheter with a wide canal attached to a funnel by means of a rubber tube may be used. Instruments should be disinfected. If complications due to the effect of potassium iodid on the heart are feared, sodium iodid may be used in its place. It is stated that 92 per cent of the cows treated by this method recovered. The percentage of recovery by the usual methods of treatment was 50 to 60.

Life history of the sheep-scab mite (Psoroptes communis), C. P. GILLETTE (*Canad. Ent., 31 (1899), No. 1, p. 9*).—In order to ascertain how long a time should intervene between the first and second dippings of sheep for the cure of scab, the author undertook to determine the period of incubation and also the time elapsing from the deposition of the egg to the time that the mite from that egg, if a female, may itself deposit eggs. It was ascertained that it requires 4 days for a newly deposited egg to hatch and the entire time elapsing from egg to egg would be about 14 or 15 days. As there would be eggs in all stages of incubation upon a sheep when the latter is dipped for the cure of scab, the author states that a second dipping should follow not sooner than 5 nor later than 10 days after the first dipping.

Tuberculosis of cattle, B. BANG (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 480-494*).—A general article. The topics covered are the desirability of freeing herds from tuberculosis; infection of cattle stabled and herded together; value of sanitary conditions; infection of swine, calves, and other animals, and man by the use of milk of tuberculous cows; accuracy of the tuberculin test; success of measures against tuberculosis in Denmark; and the advantages of suppressing bovine tuberculosis.

Tuberculosis, W. SAUNDERS (*Canada Expt. Farms Rpt. 1897, pp. 70-75*).—A detailed report is given of the results of a tuberculin test at the central farm.

Brief notes are also given of testing the herds at the experimental farms at Brandon, Indian Head, and Agassiz.

Remarks on tuberculosis in cattle, W. LONG (*Lancet [London], 1898, No. 15, p. 932*).

A comparison of the temperatures of healthy and tuberculous cows, F. L. RUSSELL (*Maine Sta. Rpt. 1897, pp. 167-172*).—The temperature of 6 tuberculous and 6 healthy cows was taken 3 times a day for 40 days. The results are summarized in tabular form. In the author's opinion the results are negative so far as showing any difference in temperature between healthy animals and those slightly tuberculous.

The prophylaxis of tuberculosis, E. LECLAINCHE (*Rev. Tuberculose, 1898, No. 3, pp. 235-248*).

A case of tuberculosis in a horse, G. PORTET (*Rev. Vet., 24 (1899), No. 2, pp. 73-81*).—A report of a case of tuberculosis and a *post-mortem* examination.

Tuberculous meat and milk, J. NIVEN (*Med. Mag. London, 1898, No. 10, pp. 786-793*).

Contributions to study of the so-called foot rot in cattle, IMMINGER (*Wchnschr. Tierheilk., 1898, No. 41, pp. 377-382; 42, pp. 389-393*).

On the influence of lecithin and lecithin products on the biology of the splenic fever bacteria, W. TARANUCHIN (*Russ. Arch. Pat. Klin. i Med. Bact., 6 (1898), No. 1*).

Concerning Streptococcus equi, E. CAPPELLETTI and M. VIVALDI (*Arch. Hyg., 34 (1899), No. 1, pp. 1-21*).—The authors cultivated *Streptococcus equi* on artificial media and report inoculation experiments with mice, rabbits, and guinea pigs.

Infectious cerebro-spinal diseases of horses, SPERLING (*Deut. Tierärztl. Wchnschr., 1898, No. 41, pp. 358, 359*).

Anchylosis of horses, ST. VON RATZ (*Monatsh. Prakt. Tierh., 10 (1898), No. 2, pp. 49-61*).

An essay on the diseases of lower animals transmissible to man, E. MARRISON (*Vet. Jour., 1898, No. 10, pp. 241-252*).

A contribution to the subject of the specific effect of serums producing immunity, C. MANN (*Arch. Hyg., 34 (1899), No. 3, pp. 179-191*).—A number of experiments on the effect of different serums upon bacteria were made with rabbits.

Bacteriological investigations of animal lymph, W. DREYER (*Ztschr. Hyg. u. Infectionskrank., 27 (1898), p. 116; abs. in Hyg. Rundschau, 9 (1899), No. 4, pp. 188-191*).

Toxic effects of boracic acid, J. J. EVANS (*British Med. Jour., 1899, No. 1987, p. 209*).—The author reports the observation of toxic effects when considerable amounts of boracic acid were taken for some time.

Concerning ricinus poison, A. CUSHNY (*Arch. Exper. Path. u. Pharmakol., 41 (1898), pp. 439-448*).—A chemical study of ricinus poison is reported.

Abortion, miscarriage, slinking, slipping the calf, L. PEARSON (*Pennsylvania Dept. Agr. Rpt. 1897, pp. 478-480*).—A general article. The removal of cows that are affected with this disease is insisted upon, as well as thorough disinfection of surroundings, destruction of fetus, etc., disinfection of genital passages, and similar preventive measures.

List of cases treated by the station veterinarian during 1894 (*Alabama Canebrake Sta. Bul. 18, pp. 15, 16*).

Veterinary medicines: Their nature, properties, and doses, T. J. EDGE (*Pennsylvania Dept. Agr. Bul. 35, pp. 23*).—The author defines many of the terms applied to veterinary medicines, discusses the actions of medicines, and gives briefly the nature, properties, effects, and doses of the more important remedies.

Anatomical preparations of the horse, R. SCHMÄLTZ (*Präparirubungen am Pferd. Berlin: R. Schoetz, 1898, pp. VIII + 240*).—According to the subtitle this volume contains directions for the preparation of all the specimens necessary for studying the anatomy of the horse.

TECHNOLOGY.

Further experiments in the preservation of grape juice, J. CRAIG (*Canada Expt. Farms Rpt. 1897, pp. 103-105*).—In continuation of previous work (E. S. R., 9, p. 895) the following experiments were made on the juice of 5 varieties of grapes—Clinton, Black Elvira,

Bacchus, Brant, and Concord: Juice heated to 170° for 10 minutes, to 160° for 10 minutes, 150° for 10 minutes, 130° for 10 minutes on 2 consecutive days, not heated, and bottled cold but treated with formalin, ½ to 1 per cent. Sugar was used in all cases at the rate of 2 oz. to each pint of juice. The results are summarized as follows:

"(1) Formalin while a proved ferment arrester imparts such a disagreeable flavor to the juice that it can not be used, at least as strong as in the proportion of ¼ per cent.

"(2) Sugar added to the juice with formalin masked the flavor of the latter somewhat, but did not obliterate it entirely.

"(3) Salicylic acid, 0.175 gm. with 2 oz. sugar to each pint produced the most palatable beverage.

"(4) Samples were successfully preserved when heated for 10 minutes at 160° with sugar at the rate of 2 oz. to each pint of juice. Duplicate samples without sugar were also successfully preserved but were not generally as palatable as the former.

"(5) 160° F. seems to be the lowest safe temperature that may be used in the preservation of grape juice. The juice may be held at this temperature for 15 or 20 minutes without imparting to it any unpleasant boiled flavor."

Utilization of Indian cornstalks in Russia, W. R. HOLLOWAY (*U. S. Consular Rpts. 1898, No. 217, pp. 216, 217*).—A brief account is given of a trial by the Russian Admiralty of cellulose packing made from the pith of cornstalks.

The cornstalk as a commercial commodity (*Drainage Jour., 20 (1898), No. 11, p. 313*).—The use of the outer hard portion of the cornstalks ("shives") for paper making is briefly discussed.

The nonsugars in beets in their relation to sugar manufacture, A. RÜMPLER (*Die Nichtzuckerstoffe der Rüben in ihren Beziehungen zur Zuckerfabrikation. Brunswick: Friedrich Vieweg & Sohn, 1898, pp. 523*).

Progress in the manufacture of beet sugar in 1898, E. O. VON LIPPMANN (*Chem. Ztg., 23 (1899), No. 11, pp. 106–109*).—A résumé of work on the growing of beets, and the science and technology of the manufacture of sugar, disposal of by-products, etc.

The manufacture of starch from maize in Russia, L. KRAMM (*Abs. in Bul. Assoc. Chim. Sucr. et Distill., 16 (1898), No. 4, p. 372*).

AGRICULTURAL ENGINEERING.

Fourth biennial report of the State engineer of Wyoming, 1897–98 (*Cheyenne, 1898, pp. 304, pls. 11, figs. 11, map 1*).—Among the subjects discussed are adjudication of water rights, measurements of streams, agricultural problems and possibilities of northern Wyoming, reservoirs, and selecting State lands (especially for grazing purposes).

First biennial report of the State engineer of Utah, 1897–98 (*Salt Lake City, 1899, pp. 86, figs. 18*).—This includes a summary account of the work of the office of irrigation engineer during 1897–98, a discussion of irrigation legislation in the State, and instructions as to the preparation of plans for dams or dikes and the measurement of water (including tables of discharge over rectangular weirs).

Fourteenth annual report of the hydraulic engineer on water supply, Queensland, 1897–98 (*Brisbane, 1898, pp. 59, pls. 4, dgms. 13, maps 5*).—This report summarizes the operation of the water supply department of Queensland during the year ending June 30, 1898, giving an account of surveys in connection with flood warnings and data relating to artesian wells and irrigation. The report is profusely illustrated with plates, maps, and diagrams.

On the preservation of the water supply, being the principal results of four years' work of the expedition for the investigation of the sources of the main

rivers of European Russia (*St. Petersburg, 1898, pp. 53; rev. in Selsk. Khoz. i Lyesov., 190 (1898), No. 8, pp. 456, 457*).—During the 4 years of its existence the expedition has studied systematically 8 drainage basins with a total area of more than 4,000,000 acres. As a result of these investigations a series (16 volumes) of publications by the expedition has appeared under the title of "Works on the hydrogeological, hydrotechnical, forest, geological, soil, and meteorological phases of the general water question in the central watershed of Russia." The present publication is a summary of these works.—P. FIREMAN.

Report on the prospects of irrigation and water conservation in New South Wales, F. J. HOME (*Sydney: William Applegate Gullick, 1897, pp. 29, dgms. 36, maps 4*).—Discusses both surface and artesian supplies, but devoted especially to the feasibility of constructing 2 canals, one on the Murrumbidgee River, the other on the Murray River. Maps are given of the proposed work, and diagrams show the discharge of the 2 rivers named at different seasons of the year.

Field trials of plows, F. BOKELMAN (*Tidsskr. Landökon., 17 (1898), No. 5-6, pp. 354-378*).—An account of a 4-day field trial in Denmark with plows of different makes—4 American swing plows, 1 German plow, and 17 of the common Danish plows.—F. W. WOLL.

STATISTICS—MISCELLANEOUS.

Thirteenth Annual Report of Maine Station, 1897 (*Maine Sta. Rpt. 1897, pp. 211*).—This contains reports of the director for the year ending December 31, 1897, and the treasurer for the fiscal year ending June 30, 1897; acknowledgements; various articles noted elsewhere; reprints or abstracts of Bulletins 32-40 of the station on the following subjects: Three troublesome weeds (E. S. R., 9, p. 143), fertilizer inspection, 1897 (E. S. R., 9, p. 436), box experiments with phosphoric acid from different sources (E. S. R., 9, p. 436), the currant fly, gooseberry fruit fly (E. S. R., 9, p. 673), testing seeds (E. S. R., 9, p. 653), feeding-stuff inspection (E. S. R., 9, p. 682), fertilizer inspection, 1897 (E. S. R., 9, p. 739), stock-feeding suggestions (E. S. R., 9, p. 983), and celery (E. S. R., 9, p. 950); and a reprint with minor additions of Bulletin 42 of the station on ornamenting home grounds (E. S. R., 10, p. 355).

Preliminary report of the municipal agricultural experiment station at Vyatka for 1897 (*Vyatka, pp. 61; rev. in Selsk. Khoz. i Lyesov., 190 (1898), No. 9, pp. 716, 717*).

Agriculture in the Hawaiian Islands, H. W. WILEY (*Jour. Franklin Inst., 147 (1899), No. 1, pp. 31-52*).

Statistics of the glucose industry (*Chicago: Glucose Sugar Refining Co., 1898, pp. 63*).

Development of the text-book of agriculture in North America, L. H. BAILEY (*Book Reviews, 7 (1899) No. 2, pp. 43-46*).—This article discusses the development of the text-book on agriculture, and reviews briefly the most important works published since 1837 in their chronological order.

NOTES.

ARKANSAS UNIVERSITY AND STATION.—G. L. Teller has resigned his position to take charge of the chemical work in Chidlow Institute of Milling and Baking Technology, recently established in Chicago by David Chidlow, who was formerly chemist to the Pillsbury-Washburn Flour Mills Company, of Minneapolis.

IDAHO UNIVERSITY AND STATION.—The State legislature has made an appropriation of $14,000 to finish the university building and $20,000 for maintenance. This is the largest appropriation ever made by the State for the support of the university. A very successful series of farmers' institutes have been held in the State this winter under the direction of H. T. French, agriculturist of the station. This work is of very great value, inasmuch as the conditions affecting agricultural operations vary so much in different parts of the State. It is the first organization of farmers' institutes in the State. The agriculturist will make a special study of forage plants this season.

ILLINOIS UNIVERSITY AND STATION.—The term of office of the following members of the board of trustees of the university has expired: J. Irving Pearce, Samuel M. Inglis, Napoleon B. Morrison, James E. Armstrong, and Isaac S. Raymond. In their stead have been elected the following: W. H. Fulkerson, of Jerseyville, *ex officio* trustee, as president of the State Board of Agriculture; Alfred Bayliss, of Springfield, *ex officio* trustee, as State Superintendent of Public Instruction; Mrs. Alice A. Abbott, of Chicago; Frederick L. Hatch, of Spring Grove; and Augustus F. Nightingale, of Chicago. The board of trustees has appointed the following as members of the advisory board of the station: W. H. Fulkerson and F. L. Hatch (trustees) and Henry Augustine, of Normal, *vice* E. A. Riehl.

INDIANA STATION.—W. B. Anderson has resigned his position as assistant agriculturist of the station and retired to his farm at Otwell, Indiana, which he is to manage in the future. The vacancy has been filled by the appointment of J. H. Skinner, B. Sc., a graduate of the School of Agriculture of Purdue University.

KANSAS COLLEGE AND STATION.—W. H. Phipps, recently a member of the board of regents, has become secretary of the college and station. The following new members of the board of regents have been appointed for the term ending April 1, 1903: William Hunter, of Blue Rapids; J. M. Satterthwaite, of Douglass, and E. T. Fairchild, of Ellsworth. In addition to the appropriations previously noted (E. S. R., 10, p. 799) the State legislature has appropriated $16,500 for additional buildings and equipment for the mechanical department, $4,000 for the enlargement of the library, and $2,000 for farmers' institutes. The station has issued a press bulletin on soy beans, which has attracted considerable attention.

OHIO STATION.—On April 11 the station killed 12 cattle which had been under experiment with the tuberculin test for periods varying from a few months to nearly two years. Several hundred people were present, many coming from distant parts of the State. Perhaps the most conspicuous outcome of the experiment was the demonstration that when the tuberculin test is applied in season, affected cattle may be fattened and disposed of for beef long before the disease has become so generalized as to render their meat unsafe for food. Repeated injections of tuberculin seemed to have had a retarding rather than an accelerating effect upon the progress of the disease.

SOUTH CAROLINA COLLEGE AND STATION.—The board of trustees at their last regular meeting took the initiatory steps looking to a permanant and complete

separation of the experiment station work from that of the farm and college. At a recent meeting the chairs of botany and entomology were consolidated. This consolidates the work of these two sciences in the station also. As previously noted, live stock and dairying have been consolidated and placed in charge of C. M. Conner. Important work has been recently done by the botanist and entomologist in investigations of fungus diseases of rice. Preparations are being made to experiment on a more elaborate scale with grasses and legumes. Experiments have also been inaugurated with hop culture. A short bulletin entitled "Suggestions to auxiliary clubs" has been issued to induce cooperation of farmers' clubs with the station. Farmers' institutes will be held, where desired, during the summer and made more strictly agricultural than hitherto.

WYOMING UNIVERSITY AND STATION.—The State legislature has provided a $\frac{3}{10}$ mill tax for four years, the proceeds of which are to be used in the construction of a new building at the university. It is probable that a science hall will be built, costing about $22,000, and that work on it will be begun the coming season. This will undoubtedly greatly benefit the station by giving increased facilities for scientific work. The following new members have been appointed on the board of trustees: S. Conant Parks, of Lander, and J. A. Riner, of Cheyenne, *vice* James A. McAvoy and J. O. Churchill, whose terms of office have expired.

PERSONAL MENTION.—Arthur Devarda, adjunct to the agricultural-chemical experiment station at Vienna, has been transferred to a similar position in the station at Görz. He will be succeeded by Adolf Halla, former assistant.

Prof. Dr. R. von Wettstein, who succeeds the late Dr. A. von Kerner as professor of botany and director of the gardens and museum of the University of Vienna, assumed his new duties April 1.

Prof. Emerich Meissl, director of the agricultural-chemical experiment station at Vienna, has been appointed counselor ("Ministerialrat") to the German agricultural ministry. Dr. F. W. Dafert, director of the agricultural institute at Campinas, Brazil, has been appointed director of the station in his stead, and the place of the latter has been filled by Dr. Gustav Dutra.

The agricultural experiment station at Cöthen, Germany, which was founded in 1864, has been discontinued, owing to the death of the director, Dr. F. Heidepriem.

Dr. Wilhelm Schimper, formerly associate professor of botany at the University of Bonn, has been appointed to a chair in the University of Basel.

The British Government has established a botanic garden and experiment station in Uganda, Northeast Africa, under the direction of Alex. White.

J. H. Holland has been appointed director of the botanic gardens in Old Calabar, Western Africa.

MISCELLANEOUS.—According to *The Gardeners' Chronicle*, it has been decided to hold an arboricultural and pomological conference in connection with the horticultural section of the Paris Exposition. Preliminary papers will be accepted dealing with the following subjects: Fruit farms, cultural and economic principles, choice of suitable varieties and their use, fruit planting by roadsides, harvesting and preservation of fruit, packing fruit, cider trees and fruits—their cultivation and uses, atmospheric agencies—their influence on forced fruit trees and vines, vegetable physiology as regards fructification, practice of grafting and pruning, tariffs and conditions of transport for trees and fruits, insects, diseases, remedies, manures and fertilizers, the propagation of varieties of fruit for colonial cultivation, tuition in fruit culture, garden schools, public instruction, congresses, etc. The details of the organization will be under the direction of a committee, of which Charles Baltet will be chairman.

A semimonthly journal, *La Industria Azucarera*, devoted to the cane-sugar industry in all of its branches, and intended for circulation in all the Spanish-American countries which produce sugar, has recently been started by the Sugar Industry Company, 123 Liberty street, New York City.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director*,

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers, and Soils (including methods of analysis), and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
——— ———.—Entomology and Veterinary Science.
J. I. SCHULTE—Field Crops.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

VOL. X. NO. 10.

The irrigation investigations in charge of this Office have already been referred to in the present volume of the Record (p. 201). The appropriation for this purpose having been increased at the recent session of Congress from $10,000 to $35,000, of which sum $10,000 was made immediately available, these investigations are being further developed and the work in connection with them is being more thoroughly organized. The scope of the investigations has been more accurately defined in the last appropriation act. As there stated, funds are provided "To enable the Secretary of Agriculture to investigate and report upon the laws and institutions relating to irrigation, and upon the use of irrigation waters, with special suggestions of better methods for the utilization of irrigation waters in agriculture than those in common use, and for the preparation, printing, and illustration of reports and bulletins on irrigation; and the agricultural experiment stations are hereby authorized and directed to cooperate with the Secretary of Agriculture in carrying out said investigations in such manner and to such extent as may be warranted by a due regard to the varying conditions and needs of the respective States and Territories, and as may be mutually agreed upon."

The first bulletin prepared in connection with these investigations, which has recently been issued, contains a discussion of the irrigation laws which control the diversion and use of water from the Missouri River and its tributaries, by Prof. Elwood Mead, including papers on the water laws of Colorado and Nebraska, by the engineers of these States. Other bulletins of a similar character are in preparation.

For the present the investigations on the use of irrigation water will be largely confined to the determination of the actual amount of water used by successful farmers in different parts of the irrigated region on different soils and in the growing of different crops.

A temporary organization for the administration of these investigations has been effected by the appointment of Prof. Elwood Mead as irrigation expert in charge, and headquarters have been established at Cheyenne, Wyoming. It is hoped that some work may be done the present season in most of the States and Territories west of the Mississippi River in which irrigation is practiced to any considerable extent. Arrangements have also been made to aid the New Jersey

experiment stations in continuing their investigations, which have already attracted much favorable attention in the East.

As far as practicable the cooperation of the experiment stations will be sought in these investigations, and it is hoped that one result of this work will be that the stations will not only be able to develop their investigations relating to irrigation in the lines in which the Department will work under this appropriation, but also in other important lines involving operations by different divisions of the station. It is believed that by concentrating their efforts on problems based on the requirements of agriculture under irrigation, the stations in a number of States and Territories may materially enhance their usefulness.

It should be clearly understood that the irrigation investigations of this Department are intended to cover only a limited portion of the field of investigations relating to agriculture under irrigation which the stations and the different divisions of the Department may properly undertake. An effort will be made to mark out a line of work for these investigations which will give them a distinct place between the investigations of the Geological Survey relating to the topography and water supply of the irrigated region, and those of the different branches of the Department and stations which relate to the climate and plants of that region. Aside from the studies of the laws and institutions of communities in which irrigation is practiced, the irrigation investigations will have for their chief object the determination of the economic and profitable utilization of water in agriculture as it is supplied to the farmer through reservoirs, canals, and ditches. In these investigations, as in nearly all others relating to the complex science of agriculture, there will be many points of contact with investigations conducted under other auspices, and thus many opportunities for cooperative effort will be presented. With so large a field of operations and so great interests at stake, there will be abundant room for all the agencies now at work for the benefit of agriculture of the irrigated region to fully utilize all the means at their command. Besides the development of the irrigation investigations, the Department will, for example, continue studies of alkali soils, the native and cultivated plants and trees best adapted to the arid regions, and other related questions.

The people of that vast area of our country in which agriculture and the other industries are so largely dependent on the successful practice of irrigation, are to be congratulated that attention was more earnestly and successfully drawn to their needs during the recent session of Congress than ever before, and more ample provision than heretofore was made for studying the problems of agriculture in that region, through increased appropriations for the work of the Geological Survey and different branches of this Department.

INVESTIGATIONS ON THE METABOLISM OF MILCH COWS.[1]

OSCAR HAGEMANN, PH. D.,
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METABOLISM EXPERIMENTS WITH RUMINANTS.

When metabolism investigations are carried on with Herbivora—milch cows, for instance—other points must be considered which render the calculations still more complicated. The feeding stuffs are not as simple as in the case of Carnivora. They contain more amid compounds than flesh. The ether extract does not consist of fat alone, but of chlorophyll, wax, and similar bodies. Plant protein is not uniform in composition. While animal protein contains on an average 16 to 16.7 per cent nitrogen, there is a somewhat wider range in the case of vegetable protein. In addition to starch, the carbohydrates consist of pentoses, pentosans, gums, etc. Finally, vegetable feeding stuffs contain crude fiber, which is only in part digestible, and which is perhaps of paramount importance in investigations of this kind.

Nitrogen which is digested and is not excreted in the urine is assumed to be stored in the body, and this gain is best calculated as proteid, since, with the exception of a small part which remains in the growing tissue, the nitrogen is transformed into proteid. On the supposition that 4 per cent of the nitrogen in the lymph is nonalbuminoid nitrogen, and that the quantity of lymph is doubled by very abundant feeding, it is possible for the body to gain a considerable amount of amids without any change in the composition of the lymph. Similar reasoning might be applied to the muscles; but the ratio of the different nitrogenous bodies to each other in the muscles is not known with certainty, nor the proportion in which this nonalbuminoid nitrogen is eliminated. If, on the other hand, the tissues of the body lose water under intensive feeding, the body may possibly lose nitrogenous extractives, which appear in the urine and so introduce an error in calculating the gain of protein. However, such considerations are theoretical and have little practical value.

In determining the material digested, slight errors are introduced from the fact that the ether extract of the feces contains numerous bodies which were not originally present in the food, and the nitrogenous bodies in the feces have a different composition from those in

[1] Continued from p. 816.

the food. A more serious error, however, is caused by the crude fiber. This is not digested by the peptic and pancreatic ferments, etc., but by the action of bacteria, and, further, the digestion is not complete. The fermentation of other nitrogen-free bodies is induced by the same bacteria, and it is probable that protein is also broken down. At any rate the changes which take place are very complicated. Much light has been thrown upon this subject by Kellner's experiments with steers.[1] He found that for maintenance there was required 24,000 calories per day per 1,000 kg. live weight, or 1 calorie per kilogram per hour. In the case of steers fed hay the crude fiber of the feces has a higher carbon content and fuel value than that of the hay fed. It follows, therefore, that the crude fiber digested has a lower fuel value than that eaten. According to Kellner the fuel value of 1 gm. of pure digestible crude fiber furnishes 4.2196 calories, or, in round numbers, about the same as starch (4.18 calories per gram). Further, when hay is fed, the ether extract of the feces has a higher fuel value than the ether extract of the food. Therefore the fuel value of the digestible ether extract is also less than that of the food, being 8.322 calories per gram. Kellner gives the fuel value of the digestible nitrogen-free extract of hay as 4.232 calories per gram. These illustrations show that calorimetric analysis is much more delicate than the ordinary methods of proximate analysis.

In calculating the fuel value of protein it should be borne in mind, as stated above, that while practically all the amid nitrogen of the food is resorbed, a portion is oxidized in the body and excreted in the urine. Supposing this to have the same heat of combustion as asparagin (3.511 calories per gram), the fuel value of urea at least must be deducted from this in order to estimate its maximum nutritive effect. A gram of asparagin yields 0.454 gm. of urea $\left(\frac{60}{132}=0.454\right)$, having a fuel value of 1.152 calories. A gram of asparagin (containing 0.212 gm. of nitrogen) would furnish 3.511 calories. This quantity, less 1.152, gives 2.36 calories as the available fuel value of 1 gm. of asparagin. These values are at best approximations, but the total error is not great, since such materials constitute only from 1 to 2 per cent of the total material metabolized.

According to Kellner's investigations, 3.5 calories per gram represents the physiological nutritive value of digestible organic material of meadow hay of medium quality when consumed by cattle. Such hay has the following percentage composition: Protein 1.393, fat 2.58, crude fiber 27.23, nitrogen-free extract 53.13, ash 7.06, carbon 46.16, and total nitrogen 1.6 per cent. According to Kellner, the total fuel value of the hay is distributed among its constituents as follows: Albuminoids 10.3, nonalbuminoid nitrogenous material 1.4, nitrogen-free extract 53.8, ether extract 3.6, and crude fiber 30.9 per cent. As noted above, cattle

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[1] E. S. R., 9, p. 167.

require for maintenance 1 calorie per hour per kilogram of live weight. If a steer weighing 620 kg. is fed 8 kg. of meadow hay of the composition noted above, the ration would furnish 0.7 kg. of digestible protein and 6.6 kg. of digestible nitrogen-free material (crude fiber plus nitrogen-free extract plus fat multiplied by 2.4) per 1,000 kg. live weight. It is of the utmost importance to determine the amount of hay sufficient for maintenance, since hay serves as the basis of the ration.

Oat straw contains 85 per cent of dry matter, made up of 0.468 per cent of protein, 2.27 per cent of fat, 42.41 per cent of crude fiber, 6.6 per cent of mineral matter, 0.525 per cent of nitrogen, and 46.75 per cent of carbon. Using the data furnished by Kellner's experiments, it appears that a maintenance ration can not be made up of meadow hay and oat straw of the above composition without furnishing an excess of nitrogen-free material. In Kellner's experiments a steer weighing 612 kg. lost daily 91 gm. of protein and 102 gm. of fat when fed 3.45 kg. of meadow hay (dry matter) and 4.5 kg. of oat straw (dry matter). The coefficients of digestibility of dry matter of hay and straw were shown to be as follows:

Coefficients of digestibility of dry matter of hay and straw.

	Dry matter.	Organic matter.	Crude protein.	Pure protein.[1]	Nitrogen-free extract.	Fat.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Hay	64.9	62.4	6.1	6.7	37.3	1.6	17.4
Straw	55.1	52.5	.1	1.2	25.3	.6	26.5

[1] Pure protein is calculated by assuming that for each 100 gm. of digestible dry matter 0.4 gm. of nitrogen due to metabolic products is excreted in the feces. Since the amid compounds are regarded as completely assimilated, it may be assumed that the remaining nitrogen of the feces is proteid nitrogen. Suppose that the food contained 633 gm. of protein, that 4.716 gm. of dry matter was assimilated, and that the dry matter of the feces amounted to 0.2547 gm., containing 1.795 per cent of nitrogen, or 45.72 gm. of nitrogen, the nitrogen due to metabolic products would be 18.86 gm. ($47.16 \times 0.4 = 18.86$). The proteid nitrogen in the feces, therefore, would equal 26.86 gm. ($45.72 - 18.86 - 26.86$). This is equivalent to 168 gm. of protein. Therefore the food furnished 465 gm. of digestible protein ($633 - 168 = 465$).

Suppose, for instance, it is desired to calculate the quantity of hay and straw (containing 58.5 and 53.2 kg. of digestible nitrogen-free material, respectively) which would furnish 0.7 kg. of digestible protein and 6.6 kg. of nitrogen-free material. Let X gm. equal the hay fed and Y gm. the straw. Then $61\,X+1\,Y=700$ gm. of crude protein, and $585\,X-532\,Y=6{,}600$ gm. of nitrogen-free material. Solving the equations, $X=11.48$ and $Y=-0.2$. In other words, on the supposition that hay and straw have the composition assigned to them above, a ration furnishing the desired quantities of protein and nitrogen-free material can not be made up from these feeding stuffs, since Y has a negative value. The straw contains too large a percentage of nitrogen-free material and too small a percentage of protein. Therefore the protein of the ration must be chiefly supplied by hay and the nitrogen-free material by straw, which will furnish an excess of the latter.

ENERGY REQUIRED FOR MASTICATION AND DIGESTION.

In calculating a ration for production for steers and cows it should be remembered (1) that a portion of the food must be utilized to supply energy for the labor of digestion, the amount of which is not definitely known, and (2) that fermentation takes place in the stomach and large intestines of Herbivora. The value of the latter factor may be calculated from the data furnished by Kühn and Kellner's experiments at Möckern. It was found that on an average 6.5 to 7 per cent of carbon from digestible crude fiber and nitrogen-free material was excreted as methan. According to Tappeiner's investigations cellulose adds water when it ferments, 100 gm. yielding 4.7 gm. of methan and 33.6 gm. of carbon dioxid, together with 33.6 gm. of acetic and butyric acid. These acids undergo combustion in the body, but, according to the investigations of Mallèrve only 75 per cent of their energy can be utilized. In round numbers, 100 gm. of cellulose, 4.7 gm. of methan, and 33.5 gm. of carbon dioxid contain 44.5 gm., 3.5 gm., and 9.1 gm. of carbon, respectively. In other words, in the example cited a total of 12.6 gm., or 28.3 per cent, of the carbon of digestible starch or cellulose is excreted in the form of gas, owing to the fermentation in the intestinal tract. If so much methan is produced by fermentation that its carbon content equals 6.7 per cent (average of 6.5 and 7 per cent) of the carbon of the total digestible nitrogen-free material (including crude fiber), it may be assumed that carbon dioxid was also formed in the same proportion as in Tappeiner's investigations; that is, for each 6.7 gm. of carbon of methan 17.4 gm. of carbon of carbon dioxid was produced. Therefore 24.12 per cent ($17.4+6.7=24.1$) of total starch and nitrogen-free extract has undergone fermentation. These calculations are not exact, since hydrogen is also formed in the intestinal tract. The amount for Herbivora is not known, but it is so small that the error introduced is insignificant.

The experiments made by Zuntz and the author with a horse may be cited to show the effect which the digestion of crude fiber exercises upon the consumption of oxygen and the production of carbon dioxid in respiration experiments. The horse excreted 4.7 gm. of methan and 0.2 gm. of hydrogen per 100 gm. of digestible crude fiber.

Effect of digestion of crude fiber on respiration.

	Carbon.	Hydrogen.	Oxygen.
	Grams.	*Grams.*	*Grams.*
100 gm. of crude fiber contains	44.44	6.18	49.38
4.7 gm. of methan contains	3.53	1.18	
Difference	40.91	5.00	49.38
33.5 gm. of carbon dioxid contains	9.14		24.36
Difference	31.77	5.00	25.02
Deducting the hydrogen excreted		.20	
Difference	31.77	4.80	25.02

For each 100 gm. of digested crude fiber completely oxidized in the animal body 149.99 gm. (116.49+33.5=149.99) of carbon dioxid (equal to 76.28 liters) is produced, and 98.1 gm. of oxygen (equal to 68.6 liters) is consumed from the air. The respiratory quotient is therefore $\frac{76.28}{68.6} = 1.112$.

The fuel value of the cleavage products of the crude fiber can also be calculated from the oxygen utilized and the carbon dioxid produced. One hundred grams of crude fiber has a fuel value of 418.5 calories; 4.7 gm. of methan would yield 62.7 calories (4.7×13.344 [fuel value of 1 gm.]=62.7); 0.2 gm. of hydrogen would furnish 6.9 calories (0.2×34.6 [fuel value of 1 gm.]=6.9; deducting the sum of 62.7 and 6.9 from 418.5 leaves in round numbers 349 calories. A total of 68.6 liters of oxygen would be used; that is, each liter of oxygen utilized for the combustion of digestible crude fiber produces 5.087 calories $\left(\frac{349}{68.6} = 5.087\right)$. A correction should, however, be introduced for the 33.5 gm. of carbon dioxid and about 48 calories produced by fermentation. Under certain conditions this heat is as available for the body as that produced by the oxidation of materials in the tissues. Further, according to the investigations of Munk and Mallèrve sodium butyrate and sodium acetate may be burned in the body, but the metabolism is also increased so that at best only four-fifths of their nutritive value is available. After deducting the 48 calories due to fermentation from the 349 calories per kilogram of digestible crude fiber mentioned above, there remain 301 calories. Assuming that only four-fifths of this is available, 100 gm. of digestible crude fiber yields for the body 240.8 calories. Using this value, 1 liter of oxygen from the inspired air would produce 3.51 calories ($240.8 \div 68.6 = 3.51$).

Energy is required for taking food into the mouth, chewing it, and for chewing the cud, and for all the processes of digestion. More or less energy is also required for the secretion of saliva and other digestive juices, and for taking up the digested material into the blood and lymph. The food must be moved through the intestinal tract, and finally the undigested matter must be excreted. Further, the labor of digestion causes increased activity of the heart and lungs. The resultant of all the energy expended is heat, and only a part of this heat is necessary for maintaining the body temperature. It is probable that when milch cows are fed an abundant diet so much heat is produced by the labor of digestion that a portion is radiated from the body unused.

It is plain, then, that a deduction must always be made from the total energy of a maintenance ration to cover the labor of digestion. The labor of chewing and digesting increases with increased amounts of crude fiber in the food. This has been shown by many experiments with cattle and horses. Zuntz and the writer found that with a horse the labor of chewing and digesting amounted to 260 calories per 100

gm. of crude fiber in the food. Values for milch cows are necessarily somewhat different, since the processes of digestion in ruminants and horses are dissimilar. In the case of a horse, protein, fat, and carbohydrates are acted upon by the digestive juices and absorbed in the stomach and small intestine. The cellulose and materials which have escaped digestion, because the walls of the cells in which they are inclosed have not been broken, finally reach that portion of the intestinal tract where fermentation takes place. The fermentation renders the crude fiber soluble, and further, when the cell walls are thus destroyed the nutrients which escaped digestion earlier can be reached by the digestive juices and absorbed. The act of moving the crude fiber through the long intestine to the point where fermentation takes place requires an expenditure of energy which may safely be assumed to reach 2.65 calories per gram of crude fiber in the food.

In the case of ruminants the food is retained for a long time in the first stomach and undergoes very active fermentation. This renders a large portion soluble and diminishes the amount of crude fiber, so that only a portion of the crude fiber must pass through the whole intestinal tract, the exact amount of which is not known. At all events, this step in digestion requires the expenditure of less energy than in the case of horses. On the other hand, chewing the cud requires a large amount of energy; so that it is not impossible that the total labor of digestion is fully as great in ruminants as in horses.

Cattle digest in round numbers 60 per cent of the crude fiber consumed. Using Kühn's data, Kellner has calculated that owing to fermentation 10 per cent of the digestible carbon is excreted in the form of hydrocarbons. Thus, of 100 gm. of crude fiber fed, 60 gm. is digestible, and 36 per cent, or 21.6 gm., undergoes fermentation. This has a fuel value of 52 calories $\left(\frac{240.8}{100}\times 21.6=52\right)$. The total energy of the 38.4 gm. $(60-21.6=38.4)$ of digestible crude fiber remaining is available. Since this is 4.18 calories per gram, the total would be 160 calories. In other words, 100 gm. of crude fiber in the food, of which 60 gm. is digestible, furnishes the body 212 calories $(52+160=212)$. Since a horse requires 265 calories, this amount would be insufficient. Information is lacking for ruminants, especially milch cows, and special respiration experiments will need to be made in which rations containing large and small amounts of crude fiber are fed before statements such as the foregoing can be made with certainty. From what has been said it is probable that the labor of chewing and digesting food is less with ruminants than with horses, so that possibly the cleavage of crude fiber furnishes an amount of energy sufficient for digesting it.

The total labor of digesting fat in the case of man and dogs is not great. For protein and carbohydrates it is somewhat greater than for fat, amounting, according to the investigations of Magnus-Levy, aside from the labor of chewing, to about 9 per cent of the total energy of

the digested material. This is the value assumed for pigs fed rice. This value and other data can be calculated for swine by comparing Meissl's[1] work on the formation of fat in pigs when rice is fed with the values obtained in metabolism experiments with fasting swine.

One of the pigs weighed 71 kg. and was fed 2,000 gm. of rice daily. Ten liters of water and 10 gm. of salt were given in addition. The rice had the following percentage composition: Water 13.13, nitrogen 1.09, carbon 39.29, protein 6.81, fat 0.82, starch 78.76, crude fiber 0.09, and pure ash 0.39. The materials consumed in the food and excreted in the feces, urine, and respiratory products, and gained by the body per day are shown in the following table:

Metabolism experiment with pigs.

	Nitrogen.	Protein.	Fat.	Starch.	Crude fiber.	Carbon.	Ash.
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Food consumed contained	21.8	136.2	16.4	1,575.2	1.8	785.8	19.8
Feces contained	3.7	23.2	4.3	7.0	1.5	19.6	4.1
Digested	18.1	113.0	12.1	1,568.2	.3	766.2	15.7
Urine contained	10.3	64.4	....	....	....	12.0	13.2
Remainder	7.8	48.6	12.1	....	....	754.2	2.5
Excreted in the breath	....	....	....	....	....	415.0	....
Gained by the body	7.8	48.6	12.1	....	....	339.2	2.5

The protein, fat, and crude fiber digested contained in round numbers 69.2 gm. of carbon. The total digested carbon of the food was 766.2 gm. Therefore starch must have furnished 697 gm. ($766.2 - 69.2 = 697$). The 48.6 gm. of protein gained contained 25.8 gm. of carbon and the 12.1 gm. of fat contained 9.3 gm. of carbon. Since the total carbon gained was 339.2 gm., 294.1 gm. must have been obtained from starch, and must have been retained as fat. It follows that each gram of digestible carbon from starch furnished 0.422 gm. of carbon for the formation of fat $\left(\frac{294.1}{697} = 0.422\right)$. There was excreted in the breath 21.4 gm. of carbon dioxid per kilogram of weight $\left(\frac{415.11}{3.71} = 21.4\right)$,[2] which would contain 15.564 gm. of oxygen; 10.3 gm. of nitrogen was excreted in the urine, and 0.906 gm. of protein was broken down per kilogram of body weight $\left(\frac{10.3}{71} \times 6.25 = 0.906\right)$. As noted above, this would require 1.23 gm. of oxygen ($1.358 \times 0.906 = 1.23$), and would produce 1.36 gm. of carbon dioxid ($1.507 \times 0.906 = 1.36$). There was stored up as fat 294.1 gm. of carbon from starch; therefore, the fat formed from starch per kilogram of live weight was 5.421 gm. $\left(\frac{294.1 \times 100}{76.54} \times 71 = 5.412\right)$. As previously noted, when 44 gm. of fat

[1] Ztschr. Biol., 22 (1886), p. 84.

[2] CO_2: $C = 44:12 - 11.3$. Therefore $C \times \frac{11}{3} = CO_2$.

was formed from starch, 51.07 gm. of carbon dioxid was produced at the same time. For this no oxygen from the air was required. The amount of carbon dioxid produced by the formation of 5.412 gm. of fat would therefore be 6.28 gm. If the 0.3 gm. of digestible crude fiber be neglected and the total nitrogen in the urine be regarded as derived from the cleavage of protein, since the rice fed contained practically no nonprotein nitrogen and the total protein content was small, the respiratory quotient of the pig may be calculated as follows: The oxidation of protein required 1.23 gm. of oxygen, producing 1.36 gm. of carbon dioxid. The fat formed from starch required no oxygen and produced 6.28 gm. of carbon dioxid. The oxidation of starch required 10.01 gm. of oxygen and produced 13.76 gm. of carbon dioxid. The total oxygen required was therefore 11.24 gm. and the total carbon dioxid produced was 21.40 gm. The respiratory quotient would be $\frac{21.40 \div 1.96633}{11.24 \div 1.43003} = \frac{10.88}{7.86} = 1.385.$

A fasting pig weighing 141 kg. excreted 9.8 gm. of nitrogen in the urine and 217 gm. of carbon. At a weight of 71 gm. the pig would have produced more carbon dioxid, in the proportion of $\sqrt[3]{141^2} : \sqrt[3]{71^2}$, since the metabolism of small animals is intense and the cleavage (Stoffumsatz) is equal to the cube root of the square of the live weight. Of the 217 gm. of carbon in the expired air, 191.8 gm. came from the cleavage of fat, the cleavage of protein causing 9.8 gm. of nitrogen in the urine, which would have necessitated the excretion of 25.2 gm. of carbon in the breath as carbon dioxid ($217 - 25.2 = 191.8$). In the case of the pig weighing 71 kg. the oxidation of 2.15 gm. of carbon from fat and 0.282 gm. of carbon from protein furnished the energy expended per kilogram of live weight $\left(\frac{191.8 \times 27.1}{141} \times 17.15 = 2.15\right)$.[1]

As noted above, the oxidation of 1 gm. of carbon from fat liberates 12.4 calories. Therefore 2.15 gm. of carbon from fat would furnish 26.7 calories; and 0.282 gm. of carbon from protein would furnish 2.8 calories $\left(\frac{100}{41.1} \times 4.1 \times 0.282 = 2.8\right)$. Therefore the energy per kilogram of live weight would be $26.7 + 2.8 = 29.5$ calories.

In the case of the pig fed 2,000 gm. of rice the oxygen utilized in the oxidation of protein was 1.23 gm., or 0.86 liters; that is, 0.906 gm. of protein was oxidized and 3.7 calories of energy was produced ($0.906 \times 4.1 = 3.7$). In the same experiment 10.1 gm., or 7 liters, of oxygen was required for the oxidation of starch, and this furnished 35 calories $7 \times 5 = 35$). Further, 6.28 gm., or 3.2 liters, of carbon dioxid was produced as an accompaniment of the fat formed. As noted above, this furnished 3.68 calories ($3.2 \times 1.15 = 3.68$). The total energy liberated was therefore $3.7 + 35.0 + 3.7 = 42.4$ calories. The 3.7 calories furnished by the formation of fat played no part in the labor of digestion. Deducting this amount from the total (42.4) leaves 38.7 calories. The energy

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[1] $27.1 = \sqrt[3]{141^2}$; $17.15 = \sqrt[3]{71^2}$.

produced by the fasting animal performing no labor of digestion was 29.5 calories. Therefore 9.2 calories (38.7 — 29.5 = 9.2) represents the labor per kilogram of live weight expended in digesting 28.17 gm. of rice (the amount consumed per kilogram of live weight). The digestible matter in 28.17 gm. of rice had a fuel value of 100.5 calories $\left(\frac{113}{71}\times 4.1+\frac{1{,}568.2}{71}\times 4.18+\frac{12.1}{71}\times 9.5=100.5\right)$.

In the case of the soaked rice the labor of chewing can be left out of account. The labor of digesting rice which contains practically no crude fiber required an expenditure of energy equal to 9.2 per cent of the total energy of the digestible food.

In the absence of more accurate data it can be said that in the case of cattle crude fiber yields the same amount of energy that is required for its digestion. The labor of chewing and digesting the remainder of the food may be said to equal 10 per cent of the energy of the digestible nutrients; and further, 24.1 per cent of the nitrogen-free material undergoes fermentation.

According to Kellner's calculations, a basal ration for maintenance must furnish per 1,000 kg. of live weight 0.7 kg. of digestible protein, and 6.6 kg. of nitrogen-free material, including 2.1 kg. of crude fiber.

In a metabolism experiment made by the writer with a milch cow, the factors determined were the amount and composition of the food, urine, feces, and milk, as a respiration apparatus was not available. The details of the experiment were as follows:

CALCULATION OF RESULTS OBTAINED WITH COWS.

During the test the cow weighed on an average 440 kg. and consumed daily 5.4 kg. of wheat bran, 2 kg. of straw, 2.82 kg. of hay, 23.5 kg. of fodder beets, 30 kg. of water, and 30 gm. of salt. The preliminary period covered 15 days. The urine and feces were collected for 7 days. On an average 13.604 kg. of urine and 25.814 kg. of feces (equal to 4.419 kg. of dry matter) and 9.998 kg. of milk, containing 12.1 per cent of dry matter and 3.35 per cent of fat, were excreted per day.

The amounts of nutrients in the food and in the feces, with the coefficients of digestibility, are shown below:

Composition of food and feces and coefficients of digestibility.

	Dry matter.	Nitrogen.	Crude protein.	Pure protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Pure ash and sand.	Pure ash.
	Gm.	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*
Food consumed (5.4 kg. wheat bran, 23.5 kg. fodder beets, 2 kg. straw, 2.82 kg. hay, 0.03 kg. salt)	11,153	243.1	1,519	1,236	426	2,115	6,024	1,070	804
Feces excreted (4,409 gm. air-dry)	4,049	76 3	....	299	99	1,075	1,718	680	399
Food digested	7.104	166.8	....	937	327	1,040	4,306	390	405
	Pr. ct.	*Pr. ct.*		*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
Coefficients of digestibility	63.7	68.6	....	75.8	76.8	49.2	71.5	....	50.4

The urine contained 96.2 gm. of nitrogen; the milk contained 50.9 gm. of total nitrogen, 47 gm. of albuminoid nitrogen, 335 gm. of fat, and 490 gm. of milk sugar. Deducting the nitrogen in the urine and milk from the amount digested shows that there was a gain of 19.7 gm. of nitrogen. As noted above, the cow digested 1,040 gm. of crude fiber, in addition to the protein, fat, and carbohydrates. According to previous statements, 924 gm. of crude fiber was required for maintenance ($0.44 \times 2{,}100 = 924$), therefore 116 gm. ($1{,}040 - 924 = 116$) of crude fiber was digested in excess of the amount required, and had no nutritive value because it was fermented, yielding carbon dioxid, water, and heat, the latter only being of use to the body. This necessitated an expenditure of 10 per cent of the total energy of digestion, on the supposition ordinarily made, and leaving out of account the fact that the energy derived from crude fiber merely covers the labor of chewing and digesting it.

On the basis of the nitrogen excreted in the urine, 577 gm. of protein ($96.2 \times 6.25 = 577$) was required for maintaining the animal. Deducting this amount from the total amount consumed leaves 422 gm. for milk produced and flesh gained. Some idea of the amount of nitrogen-free extract which was required for maintenance may be obtained from the following: The fuel value of digestible protein is 4.1 calories per gram, of starch 4.18 calories per gram. The two substances have practically the same value. An animal weighing 1,000 kg. requires 5.2 kg. ($0.7 + 6.6 - 2.1$ (crude fiber) $= 5.2$) of protein and nitrogen-free extract for maintenance. An animal weighing 440 kg. would therefore require $440 \times 5.2 = 2{,}288$ kg. As noted above, 577 gm. of protein was necessary for maintenance; therefore the nitrogen-free extract must have been equal to 1,711 gm. ($2{,}288 - 577 = 1{,}711$). The cow digested a total of 4,306 gm. of nitrogen-free extract. Deducting the 1,711 gm. necessary for maintenance, there remains 2,595 gm. Of this amount 24.1 per cent, or 625 gm., would be lost by the fermentation which takes place in the intestines, leaving 1,970 gm. of nitrogen-free extract available ($2{,}595 - 625 = 1{,}970$).

The labor of digestion would require 10 per cent of the 442 gm. of protein, 327 gm. of fat, 2,595 gm. of nitrogen-free extract, and 116 gm. of crude fiber (the amount previously calculated to be in excess of that required for maintenance). The amount of protein metabolized is shown by the excretion of nitrogen in the urine. Furthermore, as noted on p. 816, nitrogen-free extract can take the place of fat in the ratio of 44 : 107, *i. e.*, 2.4. Hence, the value of a ration can be calculated in terms of nitrogen-free extract, or "nutrients" in the sense in which Wolff used the term, giving $442 + (327 \times 2.4) + 2{,}595 + 116 = 3{,}838$ gm. of nutrients. Deducting 10 per cent of this amount, or 384 gm. from the 1,970 gm. of nitrogen-free extract, there would remain 1,586 gm., which may be assumed to be starch, sugar, or similar carbohydrates. Therefore the cow had at her disposal for milk production

442 gm. of protein, 327 gm. of fat, and 1,586 gm. of carbohydrates. The milk contained 318 gm. of protein, 335 gm. of fat, and 490 gm. of carbohydrates. The difference shows the material gained or lost by the body. That is, the body gained 124 gm. of protein and 1,096 gm. of carbohydrates, and lost 8 gm. of fat. The 1,096 gm. of carbohydrates would suffice for the formation of 465 gm. of fat $\left(1{,}096 \times \frac{1}{2.4} = 465\right)$. Deducting the 8 gm. of fat lost, the total gain to the body was 457 gm. of fat. On the supposition that 30 gm. of protein is required for the growth of horns, hide, and hair, there remains 94 gm. of protein and 457 gm. of fat. Lean cow flesh contains 20.7 per cent of protein. The protein gained is therefore equivalent to 454 gm. of flesh.

As will be seen, a number of suppositions are necessary in these calculations, since no investigations have been made which cover some of the points—for instance, the energy employed in chewing and digesting food. That the calculations are substantially correct, however, is shown by the data which are available concerning the formation of fat in the animal body when an excess of carbohydrates is fed. Kellner has calculated from his own and Kühn's experiments that from each kilogram of digestible starch in excess of the amount required for maintenance 200 to 240 gm. of fat may be produced. As has been stated (p. 816), at most 44 gm. of fat could be formed from 107.13 gm. of starch; that is, 1 gm. of fat from 2.435 gm. of starch. Using this value, 411 gm. of fat would be formed from a kilogram of digestible starch instead of 200 to 240 gm. This difference is due to the labor expended in digestion and to the fermentation which takes place. As previously noted, it may be assumed that 10 per cent of the energy of a maintenance ration is expended in the labor of digestion.[1] According to the investigations of Magnus-Levy, little labor is expended in digesting fat, and considerable energy is required for the digestion of starch. When starch alone is consumed the labor of digestion may be assumed to be from 17 to 25 per cent of the total energy of the food. Assuming that it is 21 per cent and that 24.1 per cent of the total food undergoes fermentation, the amount of digestible starch available for the formation of 411 gm. of fat can be calculated as follows:

Let X = this quantity, then $X \times \frac{24.1}{100}$ = amount fermented, and $X \times \frac{21}{100}$ = expenditure for labor of digestion when 1 kg. of fat is formed from starch. The equation would therefore be $\frac{24.1}{100}X + \frac{21}{100}X + 1 = X = 1.82$ kg. of starch. It follows that 1 kg. of digestible starch would serve for the formation of 227 gm. of fat, or about the mean of the quantities given by Kellner.

[1] Ten per cent is probably the minimum value, though this can not be said with certainty. Respiration or respiration calorimeter experiments are necessary before this can be determined accurately.

It should also be borne in mind in experiments with ruminants that the nitrogenous extractives serve as protectors of protein, and hence have a value greater than that indicated by their heat of combustion. Weiske, Meier under the writer's direction, and later Kellner have shown that with ruminants asparagin serves as a protector of protein. The most reasonable explanation is that the bacteria which cause fermentation in the intestinal tract use amid bodies as a nutrient in place of protein. If there is an abundance of amids present the bacteria use little protein, and when the supply of amids is limited protein which would have served for the needs of the body is utilized. The micro-organisms form protein from amid nitrogen by using it, together with carbohydrates, as a source of energy for the formation of cell plasma. They die and are eventually digested, and thus the body gains protein formed from amids.

Closely connected with the foregoing is the so-called depression of digestion. If a large quantity of starch or feeding stuffs rich in starch is added to the food of ruminants it has been observed that the digestibility of the nutrients, especially of protein and crude fiber, is diminished. If sufficient protein is added to the normal ration plus starch, the digestibility of the nutrients again becomes normal. This is undoubtedly explained by the fact that the bacteria in the stomach of ruminants serve to render the crude fiber soluble. When an abundance of starch is present they attack this, breaking down the starch molecules and leaving an equivalent quantity of crude fiber unchanged. In other words, many cell walls are not acted upon, and the digestive juices can not reach the cell contents. It is clear, therefore, that diminishing the digestibility of crude fiber must also diminish the digestibility of protein and fat. However, when protein is added to such a ration, or, as Kellner has recently pointed out, asparagin or ammonium acetate, the bacterial action is greatly increased and the digestibility of the crude fiber becomes normal.

CALCULATION OF RATION FOR A COW WITH CALF.

In calculating a ration for a pregnant milch cow, a number of suppositions are necessary. The ration for such a cow 4 months with calf, weighing 600 kg. and producing 12 kg. of milk daily, containing 4 per cent of protein, 5 per cent of milk sugar, and 3.5 per cent of fat, must be so adjusted that the general condition of the animal remains unchanged; that is, the ratio of fat to lean in the body, etc. The cow requires the nutrients for the formation of milk and for the unborn calf. On the supposition that, as the fetus increases in weight the milk yield diminishes, the amount of nutrients required by the fetus at any time—when 3 months old, for instance—can be calculated. A new-born calf weighs about 40 kg. The body contains about 26 kg. of water, 2.5 kg. of mineral matter, 1.5 kg. of fat, and 10 kg. of protein, including the proteid bodies in horn, hoofs, etc. This quantity of pro-

tein and fat is supplied by the maternal organism in 284 days, or at the rate of 35.2 gm. of protein and 5.3 gm. of fat per day. So far as is known the unborn calf itself metabolizes materials, and can not utilize the protein of the maternal organism directly. These materials undergo a loss during metabolism. It may be assumed that the maternal organism must supply about 20 per cent more protein and 10 per cent more fat than is actually required in order to make good this deficiency. That is, 42.2 gm. of digestible protein and 5.8 gm. of fat, or an equivalent amount of carbohydrates, is necessary for the formation of the 35.2 gm. of protein and 5.2 gm. of fat mentioned above. Although the fetus requires more material as it increases in size, the average requirements for the fourth month are the quantities given. The 12 kg. of milk produced would contain 480 gm. of protein, 420 gm. of fat, and 600 gm. of milk sugar. Therefore the cow would require $480+42.2=522.2$ gm. of protein for milk production and for the fetus, in addition to a sufficient amount of other material, which may be most conveniently expressed in terms of energy. The fuel value per gram of the protein under consideration is 5.711 calories; of the fat, 9.231 calories; and of the milk sugar, 3.952 calories. If a maintenance ration consists of 8 kg. of meadow hay of good quality, the materials added to make it a productive ration—for instance, peanut cake and fodder beets—must supply 522.7 gm. of digestible protein. Fodder beets contain very little protein, and without introducing much error it may be assumed that 50 per cent may be digested and assimilated. The protein of peanut meal contains 18.2 per cent of nitrogen (instead of the usual 16 per cent), therefore, 100 gm. of digestible nitrogen of peanut meal could be stored in the body or used for milk production only in the proportion $\left(\frac{100\times 16}{18.2}=87.9\right)$. Seventy-three per cent of the nitrogen of peanut meal is digestible. Assuming that peanut meal contains 7 per cent of albuminoid nitrogen, 100 gm. would supply the body with 28.1 gm. of available protein $\left(\frac{7\times 16}{18.2}\times\frac{73}{100}\times 6.25=28.1\right)$. One hundred grams of fodder beets furnish 0.22 gm. of pure digestbile protein. Assuming that X gm. beets and Y gm. peanut meal are fed, the equation would be $281\,Y+2.2\,X=522.2$. The fuel value of the total butter fat produced would be 3,877 calories ($420\times 9.231=3{,}877$). The fat used for the formation of the fetus would be equivalent to 55 calories ($5.8\times 9.5=55$), and the milk sugar produced would be equivalent to 2,371 calories ($600\times 3.952=2{,}371$). Therefore, in addition to the protein mentioned above, the food must supply $3{,}877+55+2.371=6{,}303$ calories. If this energy is supplied by fat and carbohydrates the ration must also contain sufficient material to make up for the labor of digestion and for the losses by fermentation.

As previously mentioned, it may be assumed that the energy supplied by crude fiber is just sufficient for its mastication and digestion, while

chewing and digesting the protein, fat, and carbohydrates requires 10 per cent of their energy, and 24.1 per cent of the energy of nitrogen-free nutrients is expended in fermentation.

The amount of protein which the ration should furnish has been determined and, to simplify the calculation, the energy required for its digestion may be assumed to be furnished by starch. One hundred grams of peanut meal contains 6.5 gm. of digestible fat and 23.5 gm. of digestible nitrogen-free extract. Deducting 24.1 per cent nitrogen-free extract for the material which undergoes fermentation, the fuel value of the fat and nitrogen-free extract would be 136.2 calories ($6.5 \times 9.5 + [23.5 - 5.7] \times 4.18 = 136.2$); and 10 per cent of this should be deducted for the labor of digesting 28.1 gm. of protein, 6.5 gm. of fat, and 23.5 gm. of nitrogen-free extract. Expressed in terms of starch, the nutrients are equivalent to 67.2 gm. ($28.1 + 6.5 \times 2.4 + 23.5 = 67.2$ gm. starch). Ten per cent of this would be 6.72 gm. of starch, or, expressed in terms of heat, 28.2 calories. Therefore 100 gm. of peanut meal supplies the animal, in addition to protein, with nutrients having a fuel value of 108 calories ($136.2 - 28.2 = 108$).

In the case of fodder beets the calculation is simpler, since the fat content may be neglected. One hundred grams of fodder beets furnishes 8.3 gm. of digestible nitrogen-free extract and 2.2 gm. of pure digestible protein. The loss of nitrogen-free extract due to fermentation (24.1 per cent) is equal to 2 gm., leaving 6.3 gm., equivalent to 26.3 calories. The 2.2 gm. of protein and 8.3 gm. of nitrogen-free extract would furnish 43.9 calories, from which should be deducted 10 per cent, or 4.4 calories, for labor of digestion. Therefore the 100 gm. of fodder beets would furnish $26.3 - 4.4 = 21.9$ calories. As a matter of fact, the energy expended for digestion must be somewhat increased on account of the crude fiber in the beets. However, no account is made of the fat in the beets and the crude fiber in the peanut meal, so it may be assumed that these factors neutralize each other.

Taking into account what has been said, we have the following equation: $1{,}080\ Y + 219\ X = 6{,}303$. The equation previously given was $281\ Y + 2.2\ X = 522.2$. Solving the equations, $Y = 1.7$ and $X = 20.4$. That is, a ration of 8 kg. of meadow hay, 1.7 kg. of peanut meal, and 20.4 kg. of fodder beets is sufficient for a cow weighing 600 kg. 4 months with calf.

It is evident from what has been said that the composition of proteid bodies is a matter of great importance in determining their value in the animal body. It is to be regretted that practically nothing is known concerning the proteid bodies in coarse fodders and green feeding stuffs, and very little regarding those contained in grains and oil cakes.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The albuminoid of wheat gluten, K. MORISHIMA (*Arch. Exper. Path. u. Pharmakol., 41 (1898), No. 4–5, pp. 345–354*).—The author agrees with Osborne and Voorhees that the alcohol-soluble part of wheat gluten contains only 1 proteid (gliadin) instead of 3, as stated by Ritthausen. The latter's preparations contained phosphorus, and this is true of the preparations of the alcohol-insoluble proteid glutenin. It was thought that possibly this phosphorus might occur as an impurity; and the author attempted to determine whether proteids of wheat gluten could be prepared entirely free from phosphorus. This work led him to the conclusion that gluten contains only a single proteid, to which he gives the name artolin.

In his investigations gluten was prepared from the finest commercial Hungarian wheat flour, using hydrant water with a considerable lime content for washing out the starch, since, as he says, the employment of distilled water gives a gluten which can not be kneaded into a compact mass. The gluten was dissolved in a weak potassium hydrate solution, the cloudy solution decanted from the sediment, and precipitated with hydrochloric acid, sufficient acid being added to give the solution a strength of 1 per cent, to aid the filtration. The precipitate was collected on bolting cloth, thoroughly washed with 1 per cent hydrochloric acid, and treated with sufficient alcohol to give a strength of 70 to 80 per cent with the water retained by the precipitate. The clear solution was filtered off after a few days and the residue treated with more alcohol, this being repeated until only a very small residue remained. These alcoholic solutions of the gluten were united, 95 per cent alcohol added until cloudy, and then precipitated with ether. The precipitate, consisting of hydrochloric-acid artolin, was washed with 95 per cent alcohol, and then dissolved in the smallest possible amount of water, to which a little alcohol has been added, gentle heat being employed. Where necessary the precipitate was purified by repeated solution in alcohol and reprecipitation. Finally it was freed from water by standing in strong alcohol and by drying in a vacuum over sulphuric acid.

The artolin prepared in this way was nearly free from ash and was entirely free from phosphorus, although it contained a constant amount of chlorin which could not be removed. From analysis of 4 preparations from 2 kinds of flour the author gives the formula for free artolin as $C_{185}H_{290}N_{50}SO_{58}$, and for the hydrochloric-acid-artolin, $C_{185}H_{288}N_{50}SO_{58}.2HCl$.

This artolin, it is claimed, constitutes the principal part of gluten. It corresponds in general to gliadin, although it differs somewhat in composition and in physical properties. Its properties are described.

Another substance, containing phosphorus, was obtained from the small residue insoluble in alcohol, mentioned above. This body was present only in small amount, and is thought to be a second constituent of gluten. The substances gliadin, mucedin, gluten fibrin, glutenin, and gluten casein are believed to be mixtures of artolin and this phosphorus body united with a base, as lime. The author is not certain whether or not the phosphorus body is an albuminoid, but will investigate it further.

The inversion of sugar by salts, L. KAHLENBERG, D. J. DAVIS, and R. E. FOWLER (*Jour. Amer. Chem. Soc., 21 (1899), No. 1, pp. 1–23, fig. 1*).—The method of experimentation is described, and the results are given for trials with salts of aluminum, manganese, zinc, cadmium, nickel, copper, mercury, iron, and ammonia.

"The main results of this investigation may be summed up briefly as follows:

"(1) The freezing point method may be successfully employed in determining the speed of the inversion of sugar.

"(2) When the metals are arranged in a series according to the speed with which their salts of the same acid radical invert sugar, it appears that the order is similar to that of the electrochemical series. Aluminum forms a notable exception. In spite of the high position of this metal in the electrochemical series, its salts invert sugar more rapidly than those of any other metal thus far tested.

"(3) Chlorids invert sugar more rapidly than sulphates, because the ironizing tendency of chlorin is greater than that of the sulphuric radical."

The rapid detection of perchlorate in nitrate of soda, P. NYSSENS (*Bul. Assoc. Belge Chim., 12 (1898), No. 5–6, pp. 187, 188; abs. in Chem. Centbl., 1898, II, No. 26, p. 1281*).—Into a test tube containing the nitrate of soda to be tested, introduce 15 cc. of a saturated solution of potassium perchlorate. Keep the test tube in a vessel of water at ordinary room temperature and shake from time to time. All chlorates, sulphates, and other salts usually present in commercial nitrate of soda, with the exception of potassium perchlorate, are dissolved in the saturated perchlorate solution. Filter the solution and wash the residue once with a saturated perchlorate solution and then with 85 per cent alcohol. If perchlorates are present the characteristic crystals will be found in the residue on the filter and the amount may be determined by the usual methods, or by weighing the residue and deducting the weight of insoluble impurities as determined in another portion of the sample.

On the volatile and insoluble fatty acids in butter, R. HENRIQUES (*Chem. Rev. Fett u. Harzind., 5 (1898), No. 9, pp. 169–172; abs. in Analyst, 24 (1899), Jan., p. 7*).—The author investigated several samples of pure butter unusually low in volatile fatty acids, with the idea of devising a method for distinguishing these butters from mixed butters. The method is based on the differences in the actual quantity and the average molecular weight of the volatile and nonvolatile fatty acids. The results, however, show that butters with a normal Reichert-Meissl number contained 5 to 6 per cent volatile fatty acids, those with an abnormal 4 to 5 per cent, the average molecular weight of which varied from 93.3 to 99.8; hence the results have but a negative value for analytical practice. With regard to the insoluble fatty acids, the Hehner number ranged between 86.5 and 89.1 for normal and 88.96 to 90.68 for abnormal butters; but a difficulty arose in the estimation of the average molecular weight in that the values found on drying at 105 to 110° C. (viz, 267 to 270) differed from those (256.3 to 263) obtained when the drying was effected at the ordinary temperature in a vacuum desiccator.

The author, however, considers that assuming butter to contain a large proportion of oleic acid, the above figures indicate that a considerable amount of an acid of lower molecular weight than palmitic acid is present; and that by isolating this acid and separating the unsaturated from the saturated acids it is not improbable, provided the assumption of a low average molecular weight for this undetected acid be found correct, that the presence of extraneous fats in butter may be discovered by the relatively higher molecular weight of the saturated acids they contain.

Chemical division of the Rhode Island Station, H. J. WHEELER, (*Rhode Island Sta. Rpt. 1897, pp. 166–176*).—This is a summary account of the work of the chemical division of the station during 1897 in the following lines: Fertilizer inspection, studies of methods of analysis, special chemical investigations, field and pot experiments, experiments in culture under glass, etc.; and analyses of miscellaneous materials, including mixed fertilizers, muriate of potash, calcined sulphate of potash and magnesia, carbonate of potash and magnesia, carbonate of potash, nitrate of potash, carbonate of soda, dried blood, dissolved boneblack, dissolved bone, double superphosphate, dissolved phosphatic rock, Thomas slag, sulphate of ammonia, waste lime from soda-ash works, lime, magnesium sulphate, floats, fine ground bone, tankage, and water.

Third International Congress of Applied Chemistry (*Jour. Amer. Chem. Soc., 21 (1899), No 1, pp. 73–102*).—This is a brief report of the congress held in Vienna, July 27 to August 4, 1898. It gives a list of the papers read, with abstracts in some cases and notes on the discussion; and an account of the excursions and scientific visits, with short descriptions of the institutions and laboratories visited.

Glycollic acid, one of the acids of sugar cane, E. C. SHOREY (*Jour. Amer. Chem. Soc., 21 (1899), No. 1, pp. 45–50*).—In a previous paper (E. S. R., 9, p. 721) the author

announced the discovery of glycocoll as the principal amid constituent of sugar cane. He now announces the discovery of glycollic acid in sugar cane, and describes its separation, properties, etc., and discusses its bearing in relation to sugar manufacture and sugar chemistry, as well as its physiological significance in the plant.

The combinations of carbon in humus substances, G. ANDRÉ (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 8, pp. 513-516*).—In previous articles (E. S. R., 10, p. 830) the author has reported investigations on the form of nitrogen in humus. This article discusses the form of carbon in these substances as determined by methods similar to those employed in the investigations of the nitrogen compounds.

The nitrogenous compounds in fungi, E. WINTERSTEIN (*Ztschr. Physiol. Chem., 26 (1899), No. 5, pp. 438-441*).—In this article, which is a preliminary communication, the author reviews the literature of nitrogenous constituents of fungi, and briefly reports a study of the nitrogenous material extracted from *Boletus edulis* and *Agaricus campestris*.

Is ferric chlorid volatilized when evaporated from acid solutions? L. L. DE KONINCK (*Bul. Assoc. Belge Chim., 13 (1899), No. 1, pp. 5-10*).—The author, after reviewing the work of Fresenius and Vogel, concludes as the results of his own labors that "under the ordinary conditions of analysis, the quantity of iron lost in this way may be neglected."—H. SNYDER.

A critical review of the methods of analysis of fats, A. LEMOINE (*Bul. Assoc. Belge Chim., 13 (1899), No. 1, pp. 26-39*).—A table is given showing the "saponification index" (Koettstorfer number) and the percentage of carboxyl and oxycarboxyl of fatty bodies. The author contends that it is more scientific to adopt, in place of "potash number," the terms, carboxyl for actual acidity, and oxycarboxyl for "latent" acidity of the fatty body.—H. SNYDER.

The identification and reaction of saccharose, dextrose, levulose, and maltose, A GAWALOWSKI (*Pharm. Post, 1898, p. 380*).

The chemical and bacteriological analysis of drinking waters, F. BAUCHER and G. DOMMERQUE (*Traité pratique d'analyse chimique et microbienne des eaux d'alimentation. Paris: Imprimerie Levée, 1898; rev. in Jour. Hyg., 23 (1898), No. 1157, p. 564*).

Methods for the bacteriological examination of water, W. HESSE and NIEDNER (*Ztschr. Hyg., 29 (1898), p. 454; abs. in Chem. Ztg., 23 (1899), No. 12, Repert., p. 35*).

On the determination of the value of waxes, A. HEUPEL (*Ztschr. Angew. Chem., 1899, No. 8, pp. 171, 172*).

Temperature correction tables for picnometer measurements, P. FUCHS (*Ztschr. Angew. Chem., 1899, No. 2, pp. 25-27*).

New laboratory apparatus (*Ztschr. Angew. Chem., 1899, No. 8, pp. 173-175, figs. 6*).—Describes (1) an apparatus for the volumetric determination of hydrogen, methan, and nitrogen in gas mixtures by fractional combustion with copper oxid, (2) a safety sand bath, (3) an apparatus for the quick determination of the specific gravity of gums, and (4) a universal holder.

An aerometer with temperature correction scale, P. FUCHS (*Ztschr. Angew. Chem., 1899, No. 1, pp. 15, 16, fig. 1*).

A new automatic pipette with reservoir, H. GÖCKEL (*Ztschr. Angew. Chem., 1899, No. 1, p. 10, fig. 1*).

BOTANY.

Grass culture in Iceland, P. TEILBERG (*Ber. Andra Nord. Landtbr. Kongr., Stockholm, 1897, I, pp. 310-312; II, App. 8, pp. 27*).—This article gives a description of the topography, meteorological conditions, soils, vegetation, and agricultural resources of Iceland, together with agricultural statistics and an enumeration of the most important grasses and other meadow plants. The pasture grasses of Iceland

consist mainly of *Festuca rubra*, *F. ovina*, *Agrostis vulgaris*, *Poa pratensis*, *P. cæsia*, *Anthoxanthum odoratum*, *Aira cæspitosa*, and *Alopecurus geniculatus*. *Trifolium repens* and *Alopecurus geniculatus* occur in moist places. *Achillæa millefolium* is quite abundant on the meadows, and a large number of other plants, especially sedges and the coarser grasses, are frequently found in small quantities. Other plants frequently found on the meadows are *Carex vulgaris*, *C. cryptocarpa*, *C. chordorhiza*, *C. variflora*, *C. ampullacea*, *C. limosa*, *C. dioica*, *C. canescens*, *Menyanthes trifoliata*, *Eriophorum angustifolium*, *E. capitatum*, *Juncus triglumis*, *Scirpus cæspitosus*, *Vaccinium uliginosum* and *Betula nana*. "Iceland is the land of the Cyperaceæ and the coarsest species of grasses, but cattle which through generations have become accustomed to the coarse food do well on it."—F. W. WOLL.

The seeds and seedlings of some Amentiferæ, W. W. ROWLEE and G. T. HASTINGS (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), p. 436*).—The authors state that compared with other groups, the seeds and seedlings of this group have not been observed to any extent. This fact led them to a series of studies, and their conclusions, briefly stated, are as follows: In the walnuts and hickory nuts the cotyledons correspond to the valves of the nut and are deeply two-lobed. The divisions of the embryo resembling cotyledons are each made up of valves of the cotyledons. The seeds of hickory will germinate without frost action, while those of walnut require it. The taproot of all these seedlings is very thick in young plants and very long in older ones. In the case of chestnuts and oaks the shell is spilt by swelling of the cotyledons in germination. In the species of oak studied the leaves of the seedlings were very much alike, being neither very deeply cut nor lobed. The beech is said to be the only one of all the genera examined in which the hypocotyl lengthens or the cotyledons become aerial.

Temperature of plants, F. SCHLEICHERT (*Naturw. Wchnschr., 13 (1898), pp. 469–472; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, p. 57*).—Observations on the temperature of trunks and leaves are reported, from which it appears that the temperature of the interior of the trunk of *Pavia rubra* at a depth of 12 cm. below the surface was dependent on the temperature of the surrounding air, attaining its maximum and minimum later than that of the atmosphere. It is influenced to a less extent by the temperature of the soil and of ascending currents of water, as well as by the degree to which the leaves are exposed to direct sunlight. The temperature of leaves was found in some cases to be slightly lower (0.7° C.) than that of the surrounding air, owing to transpiration. In other cases, such as thick-leaved plants of aloes and cactus, when exposed to bright sunlight the temperature was considerably higher; when the air temperature was 20° that of the interior of the leaf was 28.5° C. This difference is said not to be due to the development of heat in the leaf, but to the absorption of heat through the thick mass of leaf or stem.

Movement of plant food before the fall of the leaf, E. RAMANN (*Ztschr. Forst u. Jagdw., 30 (1898), No. 3, p. 157; abs. in Gard. Chron., 3. ser., 24 (1898), No. 610, pp. 183, 184*).—The author states that previous investigations on this subject have usually been undertaken with beech leaves, which are extremely liable to variation in structure and composition in proportion to the amount of light they receive. In order that his results might admit of comparison with those of other investigators, his experiments were conducted with leaves of beech, oak, hornbeam, and hazel. Given quantities of the leaves of these species were collected at stated periods from June to September, weighed, counted, their superficial area, average size, and weight ascertained, and their composition determined by careful analysis. An analysis was also made of the ash of 100,000 sq. cm. of leaf.

It was ascertained that the soluble mineral substances reached a maximum about the beginning of June and remained unaltered until autumn. This was especially true of potash and nitrogenous matter almost without exception. Phosphoric acid appeared to show a slight increase toward autumn, perhaps the result of separation of insoluble compounds. The insoluble forms, such as lime, either increase until the period of assimilation is finished or they attain a maximum proportion, after which they remain stationary, as is the case of silicic acid. No return movement of material could be noticed up to the end of September, and as long as assimilation was continued there was no occasion for such movement. In November green and autumn-tinted leaves were gathered from the same branches, the tinted leaves still being turgescent and showing some trace of chlorophyll. Testing these leaves with iodin showed that the green leaves were still rich in starch, while the yellow ones had little trace. The detailed results of the analyses show that tinted leaves of beech gave a decrease in the phosphoric acid and nitrogenous substances, a strong increase in silicic acid and potash, and a material increase in lime. In the oak phosphoric acid and nitrogenous matter decreased in the tinted leaves, potash remained about the same, while lime and silicic acid were nearly double the quantity found in the green leaves. In tinted leaves of hornbeam there was a decrease of potash, phosphoric acid, and nitrogenous material and a moderate increase in silicic acid. The leaves of the hazel showed the nitrogenous matter strongly decreased, potash slightly reduced in quantity, and phosphoric acid remaining about the same. Lime and silicic acid were greatly increased.

Summing up the results of his investigations, the author concludes that during the period of growth in the beech and probably other trees, the proportion of mineral substances in the stem and leaves becomes about equal early in the season and remains unaltered until the growing season is finished. Substances which are partly separated in the insoluble form gradually increase in the leaves. With the death of the leaves a considerable movement of mineral substances takes place, the nitrog-

enous substances and phosphoric acid returning to the tree probably in connection with the separation of insoluble albuminoids. Lime and silicic acid move into the leaves, and potash may either remain stationary, return to the stem, or move into the leaves, according to circumstances.

Starch distribution as affected by fungi, B. D. HALSTED (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 408, 409*).—The author has investigated starch distribution in leaves as affected by fungi, and has examined leaves of *Agrimonia mollis* affected by *Peronospora potentillæ*, of *Amphicarpæa monoica* infested with *Synchytrium decipens*, leaves of *Amarantus retroflexus* attacked by *Cystopus bliti*, and mandrake leaves affected with *Puccinia podophylli*. The leaves studied were placed in a 50 per cent solution of alcohol to remove the chlorophyll and then passed to a weak solution of iodin. In a few hours, if the leaf is thin, the starch responds to the iodin test and is located by the blue color. In the cases of the leaves just mentioned the starch was present either in the discolored spot or immediately around it; and this distribution was very striking in the mandrake leaves, the starch being very abundant in well-defined areas. None was met with beyond the small veins that served as the boundaries of the infested portions. Smutted corn leaves showed much starch in the bullate portions characteristic of the affected parts.

Stems infested with fungi showed the presence of starch, as was shown in the case of the leaves. Radish stalks which had become hypertrophied, when sliced and placed in the iodin solution became blue, while similar sections taken from a healthy portion of the same stem showed but a very small amount of starch. Similar results were also obtained with stems of purslane. Ordinarily the red cedar stem contains but little starch, but the galls made by the *Gymnosporangium macropus* abounded in it. Galls on peach roots were gorged with starch, and turnips affected with the club-root fungus carry a large amount of starch, while healthy tissue is comparatively free from it. In like manner the tubercles of leguminous plants contain much starch, while the roots bearing them are comparatively free from it.

Poisonous properties of wild-cherry leaves, F. W. MORSE and C. D. HOWARD (*New Hampshire Sta. Bul. 56, pp. 112–123, figs. 6*).—In 1894 and again in 1897 a number of cases of poisoning of cattle were reported to the station. An examination of the stomachs showed no trace of metallic poisoning, but the symptoms, together with statements relating to the feeding of the animals, seemed to indicate that death was caused by eating wild-cherry leaves.

In order to obtain some definite information on the amount of prussic acid yielded by different species of cherry leaves, investigations were carried over portions of 2 summers on the wild black cherry, choke cherry, wild red cherry, wild yellow plum, and the dwarf cherry. The first 2 species are quite common throughout the State. Investigations

showed that the leaves of the wild plum, as well as those of the cultivated varieties, seemed to be harmless. The least poisonous of the 3 principal species is the wild red cherry (*Prunus pennsylvanica*). The second species (*P. virginiana*) is more common than the former and is also more poisonous; but by far the most dangerous variety occurring in New England is the wild black cherry (*P. serotina*).

The authors state that "the poisonous property of all species of cherry leaves is due to hydrocyanic acid, popularly known as prussic acid. This compound does not exist as such in the growing leaf, but is derived from a class of substances called glucosids, of which amygdalin is the type peculiar to the cherry. This, or a closely allied body, is to be found not only in the leaves and bark, but especially in the stones of cherries, peaches and plums, and the seeds of the apple. By the action of moisture, and a vegetable ferment called emulsin which exists in the plant, a complex chemical reaction takes place that begins in the leaf the moment connection with the circulatory system is cut off. The 3 products of this reaction are hydrocyanic acid, grape sugar, and benzaldehyde or bitter-almond oil."

The popular opinion that the leaves of the wild cherry are poisonous only when in a wilted condition is proved to be erroneous, since analyses showed that freshly cut leaves yield nearly as much acid as the wilted leaves when calculated to the fresh material taken. On the the other hand thoroughly dried leaves yield a small amount of acid and as ordinarily dried, in the hay field, they might be capable of generating a considerable quantity of poison. A tabulation is given in which the analyses of the different species is shown. The average of 11 analyses of 100 gm. of wild cherry leaves gave 212 mg. of prussic acid. When wilted the amount was found to vary somewhat with the degree of wilting, varying from 244 to 294 mg. per hundred grams of weight after drying. Leaves dried to 42 per cent of their original weight contained 71 mg. of prussic acid to 100 gm. of leaves.

Marked differences were noticed between the quantity of acid obtained from the leaves wilted in bright sunlight and those wilted in darkness, the former producing the larger amount. The condition and stage of growth of the leaves has a marked influence on the amount of hydrocyanic acid occurring in them. The larger, tenderer, and more succulent the leaves the greater the amount of acid which can be developed from them. Young shoots which come up where they have been frequently mowed off are much the richest in poison, while the woody leaves from full-grown shrubs or trees contain so little acid as to render them nearly harmless. Ten analyses of the leaves of the wild black cherry from isolated shoots contained 212 mg. per hundred grams of freshly cut leaves, while similar leaves from full-grown trees contained only 106 mg.

The symptoms of poisoning and the toxic dose of prussic acid are given. The following are the authors' conclusions:

"The leaves of the wild black cherry are the most poisonous of the 3 species investigated, though all are dangerous.

"Both the wilted and fresh leaves are poisonous, while the dried are to be regarded with suspicion.

"Vigorous, succulent leaves from young shoots, which are the ones most liable to be eaten by cattle, are far more poisonous than the leaves from a mature tree or stunted shrub.

"Leaves wilted in bright sunlight to about 75 per cent original weight, or until they begin to appear slightly limp and to lose their gloss, yield the maximum amount of prussic acid."

Concerning proteid synthesis in green plants, B. HANSTEEN (*Christiania Videnskaba Selskabs Skriften, 1898, I, No. 3; abs. in Chem. Ztg., 22 (1898), No. 95, Repert., p. 291*).—The conclusions of the author, as shown by the abstract, indicate that light is not essential to proteid formation in phanerogams. This important function may take place in the dark under a number of conditions, namely, when the living cells are supplied with asparagin, glutamin, ammonia, ammonium chlorid, or ammonium sulphate and grape sugar, or when they are supplied with asparagin, ammonia, ammonium chlorid or ammonium sulphate with a reducing sugar, and when given ammonia or glycocol in connection with cane sugar and, possibly, with other nonreducing sugars. The chemical nature of the carbohydrates present is a matter of considerable importance in the transformation of amids and amido acids into proteids, since proteid formation is dependent upon the presence of carbohydrates and nitrogen compounds. The various forms of nitrogenous compounds are not equally efficient in proteid synthesis. The best source of nitrogen has been found to be ammonia, followed by others in the following order: Ammonium chlorid, ammonium sulphate, glycocol, asparagin, and glutamin. Leucin, alanin, kreatin, potassium and sodium nitrate are not adapted to proteid synthesis in *Lemna minor* when grown in the dark, and the author states that it is probably true of other phanerogams. The alkali chlorid present has a regulatory influence on the active protoplasm, in that the chlorids present tend to regulate the production of proteids and the consumption of carbohydrates in the proper proportion in the plant. An abnormal amount of carbohydrates formed will be at the expense of proteid production, and *vice versa*. When one fertilizes with potassium chlorid, the amount of chlorid will determine whether the production of plant material will proceed normally or not and this amount varies with different plants.

Formation of albuminoid substances in plants by the reduction of nitrates, A. HÉBERT (*Ann. Agron., 24 (1898), No. 9, pp. 416–440*).—The author gives a historical review of considerable of the literature relative to the formation of albuminoids, and states various theories which have been advanced by Loew, Victor Meyer, E. Schulze, Bach, Gautier, and others. A brief statement is given concerning the author's investigations on the presence and localization of hydrocyanic acid in certain plants. None were found present in a number of aroides examined, while slight quantities were found in different parts of *Ribes* spp. Hydrocyanic acid is said not to occur to any appreciable extent in the horticultural varieties of rose.

Special studies with *Aquilegia vulgaris* were made to localize hydrocyanic acid which exists in that plant. None was found present in the roots, petals, or stamens. In the leaves there was from 1 to 2 mg. per hundred grams, in the stem 3 to 6 mg., and in the buds and ovaries about 10 mg. per hundred grams of fresh material. From this it appears that only those organs of the plant containing chlorophyll are able to produce hydrocyanic acid.

From his own experiments and those reviewed, the author concludes that nitrates which are reduced in plants, pass through a hydrocyanic acid state, and this generally takes place in parts of the plant where assimilatory production of formic aldehyde predominates. It appears well established that formic aldehyde possesses great power to form combinations and polymeres, and these are closely related with the glucoses, pentoses, and hexoses. The cyanogen derivatives are equally susceptible of combination, passing through various forms which give methylamins. It has been shown by Kilani that all the sugars in plants are capable of combining with hydrocyanic acid to form nitrites. It seems probable that hydrocyanic acid formed in plant cells enters into combination with formic aldehyde, giving more or less complex nitrogenous compounds, as amids, amins, and nitrites, the fundamental products for the hydration of albumen.

The influence of Nitragin on the growth of various legumes, M. MAERCKER and H. STEFFECK (*Abs. in Chem. Centbl., 2 (1898), No. 18, p. 938*).—Various legumes were grown in pots with sterilized and unsterilized soil. The kinds of soil used were light loamy sand, humus loam, and pure sand. Each pot contained 6 kg. of soil, which was fertilized with 1 gm. of phosphoric acid in the form of Thomas slag, 1 gm. of potassium sulphate, 1 gm. of potassium chlorid, 1 gm. of magnesium sulphate, and 10 gm. of calcium carbonate. The inoculation was effective on sterilized soil in nearly all cases. With blue lupines the effect was most marked, while with alfalfa no effect was noticeable. The percentage of nitrogen increased with the yield, and the increase of accumulated nitrogen was found exclusively in the parts of the plants above ground.

Experiments with Nitragin, A. P. AITKEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 299–305*).—The author has previously reported a series of experiments conducted under his direction with this substance (E. S. R., 7, p. 906). Supplies of Nitragin for clover, beans, and vetches were distributed to a large number of farmers with directions for applying to the soil. In the different experiments which are summarized the results secured from plats with and without Nitragin varied so little as to be practically within the limits of error.

"The conditions under which we are warranted in expecting that Nitragin will be of service to agriculture are the absence of sufficient nitrogenous matter in the soil capable of producing a full leguminous crop, and the absence of the *Bacillus radicicola*, which enables the plant to obtain a sufficient supply of nitrogen from the atmosphere. It is doubtful if these two conditions will be found to coexist in any soil under rotation in this country."

A brief note is appended concerning Alinit, in which the author states that the proof that this substance can enable cereals to assimilate free nitrogen is far from complete, and the claims that it will render the application of nitrogenous manures for the growth of cereals unnecessary are at least immature.

On the use of Alinit in the cultivation of cereals, L. MALPEAUX (*Ann. Agron., 24 (1898), No. 10, pp. 482–490*).—The author reviews a series of experiments conducted with wheat, barley, and oats grown in pots and in the open field to test the effect of additions of Alinit in increasing their yield. Results seem to show that when conditions are favorable for the development of *Bacillus megatherium* (that is, when the soil is overrich in organic matter) Alinit proved very efficacious, but when the conditions were unfavorable for the development of the organism its effect amounted to nothing. It was found that in sterile siliceous soils Alinit was without any appreciable effect on the production of these cereals. The fixation of atmospheric nitrogen appeared to be through the destruction of the organic material and in soils rich in humus the intervention of this organism would prove advantageous. When added to soils of ordinary fertility Alinit did not influence the yield to any marked degree. An experiment conducted with maize for forage showed no difference in growth of plants in favor of Alinit.

Production of new types of forage plants—clovers and grasses, A. N. MCALPINE (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 135–165*).—This article is a discussion of the work being done by John Garton in the line of producing new types of forage plants, especially clovers and grasses. The methods pursued are outlined in detail and the operations of artificially crossing beans, peas, clovers, and grasses are described. The experiments are not completed, but the following are some of the results obtained thus far: *Trifolium medium* was not fertile with pollen from *T. pratense*, and *T. pratense* produced no seed when pollinated with *T. medium;* no seed whatever was produced by crossing *T. pratense* with *T. hybridum* and *vice versa;* and the results remained the same when *T. repens* was substituted for *T. pratense;* red-flowered early and late varieties of crimson clover and white-flowered late varieties when crossed with each other produced a red-flowered progeny; a wild variety of *T. pratense* and commercial red clover were found to cross readily, and it is desired to originate a variety combining the well-developed stooling habit of the wild variety and the seed productiveness of the commercial red clover.

Eighteen species of clover, grown for experiment, and 17 varieties of grasses, obtained by crossing, are briefly described.

Systematic plant introduction, D. G. FAIRCHILD (*U. S. Dept. Agr., Division of Forestry Bul. 21, pp. 24*).—The purposes and methods of plant introduction are described at some length, and the desirability of the establishment of new plant industries, the securing of new varieties of plants already in cultivation, and the collection of species for breeding purposes pointed out. Suggestions are given for

the collection of plants and the necessity for the inspection of all collections in order that noxious weeds, injurious insects, and fungus parasites may not be introduced is stated.

Annual report of the botanist of the Nebraska State Board of Agriculture, C. E. BESSEY (*Nebraska State Bd. Agr. Rpt. 1897, pp. 107-140*).—Notes are given on the collection of grass exhibited at the State Fair in 1897, in which 21 collections, numbering 1,501 specimens, were shown. Notes are given on the botanical regions and districts of Nebraska and the forage problems of the different parts of the State are discussed.

Gram, chick-pea, or Idaho pea, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circ. 7, pp. 4, fig. 1*).—A description of this plant (*Cicer arietinum*), together with notes on its uses and cultivation. Although recently reported as a new forage plant native to the Rocky Mountains, this plant has been known for centuries in the Orient. Its value as a soil renovator and for feeding purposes is shown. It is stated that the leaves possess deleterious qualities, and the forage is said to be poisonous to horses on account of the excess of oxalic acid. Cattle are also injured to some extent, although less than horses. The plant, however, is not ordinarily grown as a forage crop, but for the seeds alone.

Thirty poisonous plants of the United States, V. K. CHESNUT (*U. S. Dept. Agr., Farmers' Bul. 86, pp. 32, figs. 24*).—This is a popular edition of Bulletin No. 20 of the Division of Botany (E. S. R., 10, p. 516). In the present publication several of the less poisonous plants have been stricken out and a small amount of new matter added. The plants described are fly amanita, death cup, American false hellebore, pokeweed, corn cockle, dwarf larkspur, Wyoming larkspur, purple larkspur, black cherry, woolly loco weed, stemless loco weed, rattlebox, caper spurge, snow on the mountain, poison ivy, poison oak, poison sumac, red buckeye, water hemlock, Oregon water hemlock, poison hemlock, broad-leaf laurel, narrow-leaf laurel, great laurel, staggerbush, branch ivy, jimson weed, black nightshade, bittersweet, and sneezeweed.

Some native fodder plants, J. H. MAIDEN (*Agr. Gaz. New South Wales, 10 (1899), No. 1, p. 37*).—*Tribulus hystrix*, *Swainsona campylantha*, *Æschynomene indica*, *Rutidosis helichrysoides*, *Codonocarpus australis*, and *Croton verreauxii* are all mentioned as being valuable for forage in various parts of Australia.

An unusual phyto-bezoar, W. TRELEASE (*Pharm. Rev., 16 (1898), No. 2, pp. 66-70, pl. 1*).—Two balls composed of trichomes from cacti are described. They were taken from the stomach of a bull and were 3½ and 4 in. in diameter, 16 of them having been found in the animal.

A contribution to the physiology of roots, A. RIMBACH (*Ber. Deut. Bot. Gesell., 17 (1899), No. 1, pp. 18-35, pl. 1*).—Studies are reported on the function of roots, the author classifying them as nourishing, adventitious, supporting, and storage roots.

On the decomposition of protein during germination, PRIANISCHNIKOW (*Bot. Centbl., 77 (1899), No. 3-4, p. 107*).—In a brief abstract the author states that experiments with a number of legumes in which the rapidity of the decomposition of protein was measured showed that the curves of decomposition and respiration are quite similar, although the first runs higher, the carbon dioxid falling off. The accumulation of asparagin is said to also trace a similar curve, but it ultimately goes higher than the decomposition curve.

On the reformation of proteids from the products of metabolism, PRIANISCHNIKOW (*Bot. Centbl., 77 (1899), No. 3-4, p. 108*).—Some 2 or 3 weeks after the splitting up of the protein in germinating seeds the formation of the protein is resumed, the asparagin and other amido compounds being utilized.

The influence of light upon the synthetic processes in green plants, W. PALLADIN (*Bot. Centbl., 77 (1899), No. 2, pp. 60, 61*).—Etiolated seedlings of *Vicia faba*, which were small and yellow and contained little protein and no carbon dioxid or starch, were grown in solutions containing 10 per cent of cane sugar, which was utilized as starch. It was possible to observe the effect of light upon such plants. The intensity of respiration was more than twice as great in the light as in the dark-

ness, and crude protein was formed in about the same proportion. There appeared to be a direct relation between the intensity of respiration and the production of crude protein.

Influence of light on the aldehyde content of green leaves, J. REINKE and E. BRAUNMÜLLER (*Ber. Deut. Bot. Gesell., 17 (1899), No. 1, pp. 7–12*).—The aldehyde, which exists as condensation products in leaves, was found to be more abundant when the specimens had been kept for some time in the light.

Soil evaporation and plant transpiration, W. MAXWELL (*Landw. Vers. Stat., 51 (1898), No. 2–3, pp. 205–220*).—This article has already appeared in the *Journal of the American Chemical Society* (E. S. R., 10, p. 721).

The influence of rain upon sugar cane, H. BRÜNING (*Tropenpflanzer, 2 (1898), No. 12, pp. 363–365, figs. 2*).

On the function of hydrocyanic acid in plants, M. SOAVE (*Ann. Farm., 1898, p. 481*).—Experiments with sweet and bitter almonds.

On the utilization by the plant of the phosphoric acid in the soil water, T. SCHLOESING (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 50*).

The significance of silicic acid in plants and its relation to lodging of cereals, V. VON SWIECICKI (*Die Bedeutung der Kieselsäure als Bestandtheil der Pflanzen und ihre Beziehungen zum Lagern des Getreides. Halle, 1898, pp. 45*).

The poisonous effects exerted on living plants by phenols, R. H. TRUE and C. G. HUNKEL (*Bot. Centbl., 76 (1898), No. 9, pp. 289–295; 10, pp. 321–327; 11, pp. 361–368; 12, pp. 391–398*).

Biological studies on Alinit, J. STOKLASA (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 12, pp. 507–513; 13, pp. 535–540*).

The morphology and biology of the denitrification bacteria, H. JENSEN (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 10, pp. 401–411; 11, pp. 449–460, figs. 8*).

Symbiotic saprophytism, D. T. MACDOUGAL (*Ann. Bot., 13 (1899), No. 49, pp. 1–47, pls. 2, fig. 1*).—This work was intended to extend the knowledge of the occurrence of mycorrhiza, the physiological relation between the two symbionts, the influence of mycorrhizal arrangement upon the development of the higher plant, and the experimental formation and variation of such structures. Ten species of hemisaprophytes, 1 holosaprophyte, and 4 autophytes were studied.

On the relation which exists between the evolution of certain organs in the fungi and in phanerogams, BOUDIER (*Compt. Rend. Congress Soc. Savantes, 1898, pp. 149–167*).

The effect of ethereal oils on fungi, T. BOKORNY (*Arch. Physiol. [Pflüger], 73 (1898), p. 555*).

Contributions to the biology of Penicillium glaucum, F. GUÉGUEN (*Bul. Soc. Mycol. France, 15 (1899), No. 1, pp. 15–36, pl. 1*).—Notes are given on the effect of various fungicides on *Penicillium glaucum* and cytological studies on the same.

On the presence of a soluble proteo-hydrolytic ferment in mushrooms, E. BOURQUELOT and H. HÉRISSEY (*Bul. Soc. Mycol. France, 15 (1899), No. 1, pp. 60–67*).—Notes the presence in a number of mushrooms, as well as in *Aspergillus niger*, of a ferment capable of digesting casein.

On the presence of emulsin in lichens and fungi, H. HÉRISSEY (*Bul. Soc. Mycol. France, 15 (1899), No. 1, pp. 44–48*).—Notes the presence of emulsin in a number of lichens and fungi in which it had not been previously observed.

The scientific preservation of mushrooms and the localization of the toxic principle in them, E. PROTHIÈRE (*Compt. Rend. Congress Soc. Savantes, 1898, pp. 212–217*).

Methods in planktology, G. W. FIELD (*Rhode Island Sta. Rpt. 1897, pp. 120–149, pls. 3*).—The author describes the different methods adopted for collecting the organisms from water and points out some of the sources of error in different machines. A bibliography on the subject is also given.

The Point Judith pond, G. W. FIELD (*Rhode Island Sta. Rpt. 1897, pp. 117–119,*

pls. 2).—A description is given of the biological laboratory situated at Point Judith pond, and a brief review of the investigations which have been carried on at that point.

METEOROLOGY—CLIMATOLOGY.

Meteorological report, N. HELME (*Rhode Island Sta. Rpt. 1897, pp. 618–633*).—This includes general notes on the weather during 1897 and a tabulated record of observations on temperature, precipitation, cloudiness, and prevailing winds during each month of 1897, with a summary for the years 1890–1897, inclusive. The summary for 1897 is as follows:

Temperature (degrees F.).—Maximum, 90, September 10; minimum, 1, January 20; mean, 48.3; annual range, 89; highest monthly mean, 70.6, July; lowest monthly mean, 28.2, February; highest daily mean, 76, September 10; lowest daily mean, 6, January 19. *Precipitation* (inches).—Total (rain and melted snow), 51.25; greatest monthly, 10.25, November; least monthly, 0.89, October; greatest in 24 consecutive hours, 5.17, November 2; snow fall—total, 48; greatest monthly, 19.5, January; least monthly, 3, March. *Weather.*—Number of clear days, 129; number of fair days, 126; number of cloudy days, 110; number of days on which there was precipitation of 0.01 in. or more, 128. *Prevailing wind*, southwest.

The meteorology of 1897 (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 401–408*).—"A table gives a comparison of the winds, mean pressure, temperature, rainfall, cloud, and sunshine of 1897 as compared with the previous 41 years' averages," and the weather conditions during each month are discussed in detail with brief notes on the character of the principal crops of the year.

Results of meteorological observations made in the depressed area of the center of the continent of Asia (Luktshoun), A. DE TILLO (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 3, pp. 154–156*).

The temperature and moisture of the air in open fields and pine and beech woods, J. SCHUBERT (*Ztschr. Forst. u. Jagdw., 31 (1899), No. 2, pp. 91–99*).

Observations on the sun at the observatory of Lyons during 1898, J. GUILLAUME (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 3, pp. 158–160*).

Climate of the Klondike, J. HANN (*Met. Ztschr., Jan., 1899; abs. in Nature, 59 (1899), No. 1532, p. 448*).—A compilation of available data.

WATER—SOILS.

Lysimeter experiments, J. HANAMANN (*Ztschr. Landw. Versuchsw. Oesterr., 1 (1898), p. 399; abs. in Chem. Ztg., 22 (1898), No. 99, Repert., p. 313*).—The author reports the results of a series of investigations with lysimeters which show that drainage water removes more plant food from bare soils than from those covered with crops, the most important loss being that of nitrogen, and this was especially great in the warmer portion of the year, when nitrification is most active. The loss was smallest in those soils bearing plants which made the greatest demand upon the soil and covered the soil most completely throughout the year. In fallow soils there was a very large loss of nitric nitrogen. The largest amounts of nitrates were taken up from the soil by corn, barley, sugar beets, and horse beans, plants whose nitrogen require-

ments are very great. The loss of nitrogen was smallest in alluvial soils producing a luxuriant growth of plants.

The greatest loss of lime was observed in the bare alluvial soil. Even in soils bearing crops the loss of lime was considerable, especially where potash manures were used. It is estimated that in soils rich in lime the annual loss of this constituent may be as much as 2,676 to 3,568 lbs. per acre.

Only very small quantities of phosphoric acid were found in the drainage water of the different soils. Potash was removed in somewhat larger amounts. The loss of this constituent was greatest in bare soils, and least in soils bearing plants with extensive root systems. The loss of sulphuric acid was but slightly smaller in the soil bearing crops than in bare soils. The loss of chlorin, however, was six times as great in the bare soils as in those bearing crops. Soils bearing luxuriant vegetation yielded only a small amount of drainage water, even with abundant rainfall. For this reason the losses were reduced to a minimum in such soils. The perennial plants are best adapted to preventing loss by drainage.

Composition of drainage water from fertilized and unfertilized moor soils, with special reference to nitrogen, B. TACKE, H. IMMENDORFF, and H. MINSSEN (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 349–391, fig. 1*).—These studies were made with soils in glass cylinders 25 by 35 cm. in size, fitted with a device for drawing off the percolating water at will. The results obtained indicate that a very small part of the nitrogen compounds of upland moor soils is readily transformed into ammonia and nitrates. The rest firmly withstands such change. In lowland moor soils the amount of such readily transformed compounds is much greater. A moderate application of lime which does not completely neutralize the acids present does not increase the transformation of the insoluble nitrogen compounds, but promotes nitrification of the more readily decomposable compounds by improving the texture and aeration of the soil. The application of larger amounts of lime resulted in increased nitrification in the upland moor soils, but had little influence on lowland moor soils rich in lime. In sand-covered lowland moor soils the conditions were more favorable for nitrification than in unlimed or normally limed and fertilized upland moor soils. Applications of potash salts, phosphates, and lime in normal amounts did not materially increase the ammonia in the drainage water of upland moor soils. Kainit and Thomas slag decreased the amount of ammonia in the drainage water of lowland moor soils. When nitrate of soda was added to the other fertilizers, however, the amount of ammonia in the drainage was appreciably increased.

The phosphorus compounds of moor soils are very insoluble, and those applied in fertilizers are quite firmly fixed in the soil. With continued applications of phosphoric acid, however, more of this substance appears in the drainage.

The natural potash, magnesia, and lime of moor soils are to some extent soluble in water, but the larger part is insoluble. A considerable amount of the potash applied in fertilizers to upland moor soil passes into the drainage. The rest is quite firmly fixed in the soil. The natural potash of lowland moor soils is somewhat more insoluble than that of the upland moors. The absorptive power of the latter for potash, however, is practically the same as that of the former. Only after repeated applications of lime was the solubility of the soil potash increased. Applications of potash increased the solubility of the soil lime to a marked degree. Increased amounts of lime were not found in the drainage water following the application of lime.

Investigations on the phosphorus compounds of moor soils, B. TACKE (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 303–348*).—Twelve samples of moor soil (burnt and not burnt) were treated in a variety of ways with a number of different solvents (hydrochloric, nitric, acetic, oxalic, and citric acids, carbonic acid water, ammonium oxalate and carbonate, and water). Boiling for 8 hours with 5 per cent hydrochloric acid dissolved all the phosphorus compounds present. The larger part of the phosphorus compounds was also dissolved by 10 per cent ammonia solution, especially when the soils had been previously treated with 0.5 per cent hydrochloric acid. The phosphorus compounds dissolved from the soil by acids were found to be diffusible. Drying and heating increased the solubility of the phosphorus compounds of the soils in the above reagents.

Pot experiments with some of the soils used in the above investigations showed that the phosphoric acids of soils which had been dried or burnt was much more available to plants than that of soils not so treated.

The changes which moor soils undergo under culture and manuring, G. SCHLIEBS and H. MINSSEN (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 525–547*).—The principal change noted was an increase of potash and phosphoric acid (especially the latter) in the surface soil. There was no increase of nitrogen where nitrate of soda was used, although an increase was observed where less soluble forms of nitrogen were applied. In general, the increase in the soil supply of a given constituent under fertilization was greater the less abundant the applications of the other constituents. The increase in soil supply of potash and phosphoric acid did not as a rule result in such an increased yield as to render moderate applications of these constituents unnecessary. This is explained by the insolubility of the potash and phosphoric acid absorbed by the soil (see above). The continued use of potash salts resulted in a decrease in the lime of the surface soil, but this was partly or completely corrected by the lime in phosphatic substances, such as Thomas slag, which had been used.

Continued application of fertilizers resulted in an increase of potash and phosphoric acid as well as lime in the lower layers of the soil.

The potash, being more soluble, accumulated more rapidly here than phosphoric acid. The movement and accumulation of the different constituents in the soil are determined largely of course by the texture and tilth of the soil, the amount of rainfall, etc.

On the analysis of soil as a guide to its fertility, B. DYER (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10* (*1898*), *pp. 26–52*).—This is essentially "a popular summary of the more extensive paper" by the author, entitled "On the analytical determination of probably available mineral plant-food in soils" published in 1894 (E. S. R., 5, p. 1013). Some reference, however, is made to hitherto unpublished results obtained in a study of samples "representing not only the first 9 in. of soil, but also 2 succeeding depths of 9 in. each" from wheat plats at Rothamsted.

"[These results show] that if we regard only the total phosphoric acid, the ratio between that found in the soils phosphatically starved and that in those phosphatically manured (with superphosphate or with farmyard manure) is about 1:1.7, a difference which is sufficiently striking when the soils are all known to be from one field, but from which, as a mere analytical result, one could not draw very strong conclusions if the soils happened to be from different neighborhoods. When, however, we regard the 'available' (*i. e.*, citric-acid-soluble) phosphoric acid in the same way, we find a ratio of about 1:6. It is interesting to notice that the ratios, both for total phosphoric acid and for citric-acid-soluble phosphoric acid, are practically the same as those found in the examination of the Hoos field barley soils already discussed."

A comparison was also made of the potash content of wheat plats to which no potash had been applied for 40 or 50 years and that of plats to which potash had been applied.

"In the case of the hydrochloric-acid-soluble potash, the ratio between the 2 sets of soils is 1:1.1; but when we regard the 'available' potash, we find, as in the case of the barley soils, an overwhelming ratio of 1:8. . . .

"A knowledge of the proportion of potash soluble in hydrochloric acid is in most cases of very small value. I venture to think, however, that the determination of the potash dissolved by a dilute solution of citric acid is possessed of much more value."

The analyses of Jamaica soils, F. WATTS (*Jour. Jamaica Agr. Soc., 3* (*1899*), *No. 1, pp. 17–22*).—Mechanical and chemical analyses of 6 samples of soil from different parts of the island are reported. "These represent 3 very distinct types of soil—the red soils from Mocho in Clarendon and Brokenhurst in Manchester, the sandy soil from the St. Andrew's Plain at Barbican, and the heavier low-lying soils of Hartlands in St. Catharine." The red soils consist largely of fine silt or clay (45–61 per cent). They contain a very small amount of insoluble matter (about 19 per cent), due to an abnormal amount of soluble oxid of iron and alumina (46 per cent) and combined water. "Although lying upon the limestone, and doubtless derived from it, these soils are singularly deficient in carbonate of lime; if all the carbonic acid be calculated into terms of carbonate of lime we have only 0.58 per cent in the Mocho soil and 1.57 per cent in the case of the Brokenhurst sample." The proportion of potash in these soils is not large (0.05 to

0.15 per cent). Phosphoric acid is abundant (0.35 to 0.91 per cent) but very insoluble in 1 per cent citric acid. The proportion of humus and nitrogen is fairly large.

The Barbican soils contain a large amount of sand (44 per cent) and a small quantity of fine silt and clay (19 per cent). "The chemical analysis shows that there is a plentiful supply of potash [0.22 per cent] and of phosphoric acid [0.26 per cent] soluble in hydrochloric acid, and also that a fair proportion of each of these constituents is soluble in citric acid [0.16 and 0.22 per cent]. On the other hand, there is a striking deficiency of lime as carbonate [0.03 per cent], of humus [1.45 per cent], and of nitrogen [0.08 per cent]." A considerable portion of the lime is believed to be in the form of silicate.

The Hartlands soils contain a fair amount of sand (39 to 45 per cent), the larger part of which is quite fine. The proportion of fine silt and clay is not excessive (29 to 40 per cent). "These soils are fairly rich in potash which is soluble in moderate quantity. . . . The amount of phosphoric acid is not large and the quantity soluble in citric acid is small. . . . The proportion of carbonate of lime is small."

Influence of atmospheric agents on soil bacteria, M. CRENDIROPOULOS (*Rev. Hyg., 20 (1898), No. 8, pp. 697–705*).

Purpose, value, and method of field experiments on moor soils, B. TACKE (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 414–430, fig. 1*).—A general discussion (with plans) of this subject based upon experience at the Moor Experiment Station at Bremen.

On the presence of ferrous carbonate in the iron deposits of moors, H. SCHÜTTE (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 548–557*).—Chemical examinations showing the presence of this substance in a number of samples of bog-iron deposits are reported.

Cultivation of soil, P. P. DEHÉRAIN (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 8, pp. 474–479*).—This is a summary of investigations on the influence of different methods of cultivation, on the water supply, and nitrification in the soil, which has been noted elsewhere (E. S. R., 10, p. 727).

FERTILIZERS.

The use and value of seaweed as manure, J. HENDRICK (*Trans. Highland and Agr. Soc., Scotland, 5. ser., 10 (1898), pp. 118-134*).—This is a popular article, based principally upon investigations and observations by the author.[1]

Analyses of cut weed or black wrack (*Fucus nodosus* and *F. vesiculosus*), driftweed, principally Laminaria, and dulse (*Rhodymenia palmata*) are reported and their fertilizing value as compared with barnyard manure is discussed.

Comparative field tests of seaweed, barnyard manure, and other fertilizers on potatoes were carried out under the supervision of the author in 1895 and 1896 in 3 different localities.

"[From the result of these experiments] it will be seen that, weight for weight of manure, seaweed gives just as great a crop of potatoes as farmyard manure. When superphosphate is applied along with the seaweed the crop is in every case

[1] See also Agr. Students' Gaz., n. ser., 9 (1898), No. 2, pp. 41–49 (E. S. R., 10, p. 833).

increased, and except in [one instance], where analysis shows the soil itself to have been high in "available" phosphate, the increases are very considerable . . . Seaweed with superphosphate gave a larger crop in every case than farmyard manure with superphosphate [or potash] or with farmyard manure alone . . .

"On the other hand, dung had the advantage over seaweed in quality of produce. . . . There was no doubt that the seaweed potatoes were less mature than the dung ones. They were softer and less mealy when boiled; and in every case it was held that the results of the seaweed plats would have been improved if they could have been allowed to grow for a fortnight longer. It is therefore probable that seaweed would give even better results with late potatoes.

"As no nitrogenous manure was applied with the seaweed in any of the experiments and as [one of] the soils was very deficient in nitrogen, the results would seem to indicate that the nitrogen of seaweed readily becomes available to potatoes, and is, on the whole, of equal value to that of dung.

"The field experiments, then, confirm the results of analysis, and show that seaweed is, weight for weight, as good a manure for potatoes as dung, but that to get the best results with it it should be supplemented with phosphate. . . .

"So far as these experiments go, then, there does not seem to be much ground for the general belief that muriate of potash is not a suitable manure for potatoes."

The starfish in Narragansett Bay, G. W. FIELD (*Rhode Island Sta. Rpt. 1897, pp. 150–165, pls. 8*).—In connection with a study of the life history and habits of the starfish (*Asterias forbesii*), an enemy of the oyster, analyses with reference to fertilizing constituents were made, with the following results:

Composition of starfish.

	Calculated to live unrinsed fishes as received.	Calculated to absolutely dry starfishes rinsed with fresh water before drying.
	Per cent.	*Per cent.*
Loss by rinsing with fresh water and complete drying	65.43	....
Crude ash	20.34	58.84
Lime (calcium oxid)	9.62	27.82
Potash (potassium oxid)	.23	.66
Phosphoric acid	.20	.57
Nitrogen	1.80	5.20
Insoluble matter	.34	.97

Solubility of the phosphoric acid of Thomas slag and crude phosphates in upland moor soils as determined by the amount of free humus acids present, B. TACKE and H. MINSSEN (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 392–413*).—In these experiments, in which a variety of phosphates—including among others Florida and Carolina phosphates and Thomas slag—were tested in pots, it was found that the solubility of the phosphates depended upon the amount of free humus acids present. Neutralizing the soil with basic substances, such as lime, destroyed the solubility of the crude phosphates, although a part of the phosphoric acid of Thomas slag was still soluble under these conditions. The citrate-insoluble phosphoric acid of the slag, however, was not dissolved to any greater extent in the soil than that of the crude phosphates.

Utilization by plants of the phosphoric acid dissolved in soil water, T. SCHLOESING (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 21, pp. 820–822; abs. in Rev. Sci. [Paris], 4. ser., 10 (1898), No. 23, p. 725*).—Sterile sandy soils especially deficient in phosphoric acid were watered with nutritive solutions containing varying amounts of phosphoric acid and planted to various crops. On the soils receiving no phosphoric acid the plants made little or no growth. On those receiving phosphoric acid in proportions similar to those found in ordinary soils the plants grew well. With solutions containing 2 mg. of phosphoric acid per liter excellent crops of maize were obtained, and with solutions containing from 0.5 to 1 mg. of this substance per liter the yield of wheat was from 13.35 to 24.03 bu. per acre.

Trial of phosphates, C. O. FLAGG and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 394–408, pls. 2, dgms. 4*).—The plan of these experiments and the results heretofore obtained have been previously published (E. S. R., 9, p. 938). A hay crop was grown in connection with these experiments, and the yields in 18 6 and 1897 are reported in tables and the results described. The different materials used to supply phosphoric acid were dissolved boneblack, dissolved bone, dissolved phosphate rock, fine ground bone, slag meal, floats, raw aluminum phosphate, ignited aluminum phosphate, and double superphosphate. These substances were applied on two series of plats, one of which was unlimed, while the other had received an application of 1 ton of air-slaked lime per acre in 1894.

"The 3 insoluble phosphates, fine ground bone, slag meal, and floats, thus far maintain the lead in pounds of hay produced, slag meal holding the first place in the unlimed series. The aluminum phosphates thus far appear to be quite inferior forms of phosphoric acid when used upon an acid soil without an application of lime; and when in the raw form, even in connection with lime, produced a smaller crop than the plat which received no phosphoric acid. The ignited form, used in connection with lime, produced, in 1897, the second largest yield, but occupies sixth place in the total production for 2 years. The last one-third ration has yet to be applied as an annual top-dressing to the plats receiving the soluble phosphates before all will be on the same basis, but the lead now held by 3 forms of insoluble phosphate will doubtless give them the advantage even then."

In the 2 seasons the lime plats yielded 6,634.42 lbs. of hay per acre more than the unlimed plats. "If . . . we charge the entire cost of the lime at $8 per ton to these 2 hay crops and calculate the value of the increase in the hay crop at $14 per ton, we have a profit of $38.44 per acre due to the use of lime in connection with fertilizers on an acid soil." Redtop (*Agrostis vulgaris*) formed the bulk of the hay crop on the unlimed plats and timothy (*Phleum pratense*) on the limed plats. The use of air-slaked lime favored the growth of the timothy. "When soils are acid, timothy quickly disappears from the grass field and redtop or dent or, perhaps, sorrel takes its place."

Tests of nitrogenous fertilizers on hoed plants, C. DUSSERRE (*Chron. Agr. Vaud, 11 (1898), No. 23, pp. 668–672*).—An account is given of 2 experiments with varying amounts (200 to 500 kg. per hectare) of

nitrate of soda on fodder beets, (1) on alluvial soil recently drained, very rich in organic matter and nitrogen, and with a humus subsoil also rich in nitrogen, and (2) a dry gravelly soil, poor in nitrogen. Analyses (food constituents) of the beets grown are reported.

There was a profitable return in both cases from the use of nitrate, even with the larger applications, but naturally the return was greatest in case of the gravelly soil poor in nitrogen.

The results show in general that the nitrate was effective only when used in connection with a sufficient supply of the mineral elements phosphoric acid, potash, and lime; and indicate that the exclusive and repeated use of nitrogenous fertilizers destroys the equilibrium in the soil and reduces the yield.

Observations regarding the relative assimilability of various forms of nitrogen upon an acid soil, limed and unlimed, H. J. Wheeler, B. L. Hartwell, and G. E. Adams (*Rhode Island Sta. Rpt. 1897, pp. 241–253, pls. 2*).—This is a summary account of pot experiments begun in 1893 (E. S. R., 7, p. 378). The experiments have been made in pots 18 in. in diameter and 26 in. deep. Like quantities of dissolved boneblack, muriate of potash, and nitrogen in several forms (dried blood, tankage or ground leather, nitrate of soda, and sulphate of ammonia) have been added annually to each pot. Corn was grown in 1893, oats in 1894, rye in 1895, and barley in 1896 and 1897. The pots were divided into 2 series, one limed and the other unlimed. The data reported include yield of crop, percentage of nitrogen in dry matter, and total nitrogen removed by the crop. The results are summarized as follows:

"On a very acid (sour) soil sulphate of ammonia has worked like a poison instead of as an effective fertilizer.

"Where air-slaked lime was applied with sulphate of ammonia, the nitrogen proved nearly as valuable as like quantities in form of nitrate of soda.

"Dried blood, on the acid soil, yielded some nitrogen to the plants and proved its marked superiority to the leather.

"When used in connection with lime the nitrogen of the dried blood became nearly as effective as like amounts in the form of nitrate of soda, while nitrogen in the form of leather was very ineffective even when, by liming, the conditions for its nitrification were made as favorable as possible. That the conditions for nitrification were favorable in the limed pots is shown by the fact that the nitrogen of the sulphate of ammonia and dried blood became almost as effective as nitrate of soda.

"These results bring out plainly the fact that upon an acid soil, where nitrification progresses but slowly, much of the money invested in the best forms of organic nitrogen, such as blood, meat, and fish, is practically wasted, and since these forms make up the major part of the nitrogen of most of the commercial fertilizers sold in the State, the importance of testing soils for their acidity and supplying lime where needed can not be too strongly insisted upon."

Observations in connection with a soil test continued for 8 successive years, H. J. Wheeler and J. A. Tillinghast (*Rhode Island Sta. Rpt. 1897, pp. 177–184*).—This is an account of a continuation of an experiment begun in 1890 (E. S. R., 9, p. 936), in which

nitrogen has been applied each year in the form of nitrate of soda, phosphoric acid in form of dissolved boneblack, and potash in form of muriate of potash, with and without the addition of lime. During the earlier years the crop experimented with was corn. Subsequently a large variety of other crops were used. In 1897 the plants grown were crimson clover, common white beans, sunflower, summer squash, and corn. The results are reported in detail and summarized as follows:

"The first year's experiment with maize indicated a probable need of potash. Experiments for 3 successive years with the same crop showed in a most decisive manner that phosphoric acid was more deficient in the soil than nitrogen or potash.

"Most of our agricultural plants gave indications that their individual requirements for phosphoric acid on our soil were determinable in a soil test as well by maize as by the use of each of them.

"Sunflowers, by virtue of greater requirements for potash or of less ability to extract it from the soil, are probably not well calculated for use in determining phosphoric acid deficiencies for most other plants. White beans, summer squashes, and crimson clover seem also less desirable for such a use than the cereals.

"Liming, an unusual amount of water, or possibly both factors, seem capable of rendering assimilable some of the otherwise inert phosphates already existing in the soil."

On the substitution of soda for and its value in connection with potash, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 226–240, pls. 4*).—The experiments here reported were a continuation of those of previous years (E. S. R., 9, p. 933). The following is a summary of the results thus far obtained:

"It may be stated at this time that with each succeeding year soda, when used without potash, has steadily deteriorated in its action when compared with the results from plats manured with potash, but without soda.

"Where soda has been added in increasing quantities to a full potash ration, little or no benefit from its use has been apparent. On the other hand, the addition of increasing quantities of potash to a full soda ration, has, especially in the last 2 years, been attended with most marked gains.

"In the instances where potash and soda have both been employed in varying amounts, marked evidence of benefit from soda is noticeable in the results for 1897, particularly where the potash ration was reduced to one-fourth of the maximum amount.

"There seems to be some doubt if it would prove an economical practice to reduce the supply of potash sufficiently to gain the greatest benefit from the soda, for by so doing the total crop seems to be seriously reduced. It may be possible that certain plants may be able to make use of soda without the danger just mentioned. This point can only be determined by further experimentation.

"It is not known at present, and can not be until the analytical data are all available, whether the soda has probably acted as a direct plant food, or indirectly by virtue of its having liberated some potash or other manurial ingredients. It is hoped that something in this connection will be ready for publication in the near future."

A study of the needs of certain Rhode Island soils, H. J. WHEELER, C. O. FLAGG, and G. E. ADAMS (*Rhode Island Sta. Rpt. 1897, pp. 185–201, pls. 7*).—This is an account of cooperative experiments during 1897 in continuation of those of previous years (E. S. R.,

9, p. 937). The main results of these experiments are summarized as follows:

"In experiments with beets already conducted in 15 localities in the State marked benefit from liming has been observed in every case but one. The smallest gain has been 21 per cent, the next smallest 37 per cent, while in the other cases the crop has been practically doubled, or increased several times.

"Experiments with barley, in 1896, indicated a more or less general need of lime, but the results were far less marked than with beets.

"With but one or two exceptions the most striking benefit from liming has been noticeable, in 1897, in connection with both red clover and timothy (*Phleum pratense*) in various sections of the State. Liming increases the relative amount of timothy in mixtures of that grass with redtop, and also the total weight of the hay crop on many soils. Practically all of the reasonably heavy soils, and particularly such as are well supplied with humus, have been found to be less in need of nitrogen than of phosphoric acid."

Five years' observations upon the growth of plants upon an acid upland soil, limed and unlimed, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 202–225, pls. 2*).—The experiments in 1897 were conducted on the same plan as that followed in previous years (E. S. R., 9, p. 935). The results obtained are as follows:

"Of all the grasses thus far tested, none seemed to stand so much in need of lime on acid soil as Kentucky blue grass and timothy.

"Orchard grass and meadow fescue, though less injured by soil acidity (sourness) than Kentucky blue grass or timothy, nevertheless show great benefit from liming. Sheep fescue is also benefited by liming to a considerable extent, though it gives no promise of value for hay in this section.

"Awnless brome grass, redtop, and Rhode Island bent, though valuable grasses, do not seem to be susceptible of great injury, even upon quite acid soils. This observation furnishes a satisfactory explanation of the fact that timothy and clover give way rapidly to redtop and Rhode Island bent on many of our New England farms.

"This season's trial indicates wonderful benefit from the use of lime in the growing of asparagus. These observations are to be continued if possible.

"New Zealand spinach, like the ordinary varieties, seems to be much helped by liming.

"Spinach and asparagus give much better results from nitrogen in form of nitrate of soda than from like quantities in form of sulphate of ammonia. Experiments are in progress for the purpose of ascertaining definitely, if possible, to what this difference is due.

"Strawberries, currants, and gooseberries have shown this season some benefit from liming, yet it will be necessary to wait a year or two before definite conclusions in the matter can be drawn.

"Judging from the growth only, raspberry plants appear to show some benefit from liming, while no noticeable differences in blackberry plants have been observable.

"Delaware grapevines seem to be injured in a marked degree by sour soil, and correspondingly helped by liming, while the Concord vines appear to be comparatively indifferent in this particular.

"Among the other tests made the past season the orange quince, Golden Sweet apple, American elm, and American linden show more probability of ultimate benefit from liming than the Crawford Early peach, Baldwin apple, Bartlett pear, sugar maple, or American white birch. In future years more conclusive data should be obtainable in relation to the small fruits, orchard and forest trees."

On the action of burnt lime and marl on sandy soils, B. TACKE, H. IMMENDORFF, A. SALFELD, and F. WOLFF (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 131–150*).—Experiments in the laboratory, greenhouse, and field tend to show that fall applications of burnt lime may injuriously affect the growth of leguminous plants by the impoverishment of the soil in assimilable nitrogen. The lime, however, did not appear to affect injuriously the root tubercle organisms applied in soil, although on uninoculated soils the plants grew much better where marl was applied than where burnt lime was used. This is believed to be due to the fact that the marl contained the root tubercle organisms in considerable amount.

Field experiments on upland moor soils and moor meadows by the Moor Experiment Station at Bremen during 1892–1897, B. TACKE, F. GAAZ, and H. MENKHAUS (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 1–258, pls. 4*).—These include experiments with different crops and with different combinations of fertilizers, the use of sand on upland moors, comparison of barnyard manure and commercial fertilizers on untreated upland moors, drainage to different depths, and applications of calcareous manures.

In experiments with different forms and amounts of phosphoric acid, potash, and nitrogen on moor soils the best results were obtained on the average from applications of 100 kg. per hectare of potash, 100 to 125 kg. of phosphoric acid, and 75 kg. of nitrogen.

In comparative tests of Thomas slag, precipitated phosphate, and Algerian phosphate on upland moors, the Algerian phosphate gave a more profitable return than Thomas slag, especially when applied in somewhat larger amounts (one-fourth more) than the latter on moor soils recently brought under cultivation.

In comparative tests of kainit, carnallit, and 38 per cent "manure salt" on upland moor soils the use of concentrated manure salt was found profitable, especially on potatoes, even when applied at the rate of 200 kg. per hectare in the spring, but carnallit and kainit applied in the same way reduced both the yield and starch content of potatoes. The reduction in starch content appeared to be due not to a lowering of the percentage of starch in the dry matter, but, as a rule, to an increase of water in the tuber. The injurious effect of the potash salts appeared to be lessened by the application of basic substances, such as lime, Thomas slag, etc.

Experiments with varieties of potatoes, oats, and rye are reported, but the results are either inconclusive or mainly of local interest.

A series of experiments were made on upland moors, the surface layers of which were mixed with a layer of sand 10 to 15 cm. thick. A variety of crops were grown on the soil and they were invariably benefited by the addition of the sand. In the case of cereals the increase in the yield of straw was greater than that of grain.

Comparative tests of barnyard manure and commercial fertilizers on untreated upland moors gave inconclusive results.

The results of comparative tests of drainage of upland moors to depths of 50 to 150 cm. indicate that for potatoes and rye, which are the principal moor crops, a depth of 50 cm. gives the best results, especially for new soils. As culture continues the depth of drainage may be increased without injury.

Burnt lime, marl, chalk, and gypsum in varying amounts were compared on a number of different crops and upland moor soils. The results indicate that as a rule these manures increased the productiveness of the soil principally by improving the porosity and drainage of the soil and thus increasing the depth to which the roots of plants could descend.

In experiments on the action of different forms and amounts of potash and phosphoric acid on upland and lowland moor meadows it was found that combinations of kainit and Thomas slag gave an increased yield when other conditions of growth were favorable. Crude phosphates were found to be very effective when considerable amounts of acid were present in the soil. The character of the grasses was much improved by the use of fertilizers. An improvement was also noted in the composition of the individual grasses grown on the fertilized soil. This was shown in an increase in the percentage of protein. The grasses grown with fertilizers contained a higher percentage of water than those grown without fertilizers. The dry matter of the hay grown on fertilized soils contained higher percentages of potash and phosphoric acid than the averages given by Wolff. Hay from the lowland moors contained 2.17 per cent of potash and 0.57 per cent of phosphoric acid, while that from the upland moors contained 1.95 per cent of potash and 0.79 per cent of phosphoric acid.

Pot experiments on moor soils at the Moor Experiment Station at Bremen, B. TACKE and H. IMMENDORFF (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 259–300, pls. 19, fig. 1*).—Accounts are here given of pot experiments with upland and lowland moor soils, including tests of nitrogenous and phosphatic manures on lowland moor soils, studies on the optimum water content of upland and lowland moor soils, and on the action of underground liming and of naturally occurring compounds of phosphoric acid and iron on upland moor soils.

The experiments with nitrogenous fertilizers on lowland moor soils showed that even in cases in which the soil contained from 2.52 to 3.39 per cent of nitrogen the yields of oats, rye, and sugar beets were greatly increased by applications of nitrogen. The more favorable the conditions for nitrification and the more rapid this process took place in the soil the less the benefit from nitrogenous fertilizers.

In experiments on the action of phosphoric acid on lowland moor soils containing varying amounts of phosphoric acid, applications of phosphoric acid ceased to increase the yield of oats when the soil contained 0.44 per cent of phosphoric acid, and were without effect on the yield of wheat when the amount present in the soil was 1.23 per cent.

Only on soils very poor in phosphoric acid did water-soluble phosphoric acid produce better effects than Thomas slag containing a high percentage of citrate-soluble phosphoric acid. The after effect of the latter was also as a rule greater. Examinations of the soils used in these experiments indicated that the total phosphoric acid was not always a safe index of their phosphoric acid requirements, but this was dependent largely upon the form in which the phosphoric acid was present in the soil. Soils which contained phosphoric acid in form of vivianite, or in the transition stages between vivianite and ferric phosphate, stood less in need of phosphoric acid fertilizing than those which contained ferric phosphate.

In experiments on the optimum water content of lowland moor soils it was found that with leafy plants, like oil radish, the largest yield was obtained with the highest amount of water (75 per cent of the water capacity of the soil). With oats the maximum yield was obtained with a water content of 65 per cent. In similar experiments on upland moor soils the highest yields of both crops were obtained with saturated soil (84.7 per cent of water).

Red earth containing 2.08 per cent and vivianite containing 14.51 per cent of phosphoric acid, 2 substances which naturally occur in moors, were tested in comparison with Thomas slag. The results show that these substances have considerable value as fertilizers.

Fertilizers, E. B. VOORHEES (*New York: The Macmillan Co., 1898, pp. XIV+335*).—When we consider the relation of the experiment stations in this country to the fertilizer question it seems peculiarly fitting that the preparation of this volume of the Rural Science Series should have been intrusted to the director of an agricultural experiment station, and especially of a station like that of New Jersey, which has has done so much to promote the intelligent use of fertilizers.

As the subtitle states, the book treats of the source, character, and composition of natural, home-made, and manufactured fertilizers, with suggestions as to their use for different crops and conditions. The following is a summary of the topics treated: The natural fertility of the soil and sources of loss of the elements of fertility; the functions of manures and fertilizers and the needs of artificial fertilizers; the sources and nature of the various commercial forms of nitrogen, phosphoric acid, and potash, as well as of miscellaneous fertilizing materials, including, among others, green manures and soil amendments; the analysis and purchase of fertilizers; methods of using fertilizers; and fertilizers for special crops—cereals and grasses, potatoes, sweet potatoes, tomatoes, sugar beets, green forage plants, market garden crops, orchard fruits and berries, cotton, tobacco, sugar cane, etc.

The work is intended for "the general reader as well as the student," and aims "to point out the underlying principles and to discuss in the light of our present knowledge of the subject some of the important problems connected with the use of fertilizers."

In order that each farmer may intelligently apply the results of scientific investigation to his own conditions the author outlines a plan of farm experiments. Great emphasis is laid on the importance of the systematic use of manures and fertilizers, a chapter being devoted to a discussion of systems of fertilization adapted to various systems of rotation and farm management, conditions of soil, etc.

FIELD CROPS.

A report of progress of investigations in the chemistry of wheat, G. L. TELLER (*Arkansas Bul. 52, pp. 53–81*).—This is a continuation of the author's investigation (E. S. R., 8, p. 854). He refers to his contention that the wheat proteid designated by Osborne and Voorhees as a proteose is gliadin, and offers "further proof that the conclusion is correct."

Most of the bulletin is devoted to a study of the changes in wheat from the time the grain began to set until it was overripe. A half acre of wheat which gave promise of being very uniform was used for the investigations, but as the wheat matured the field was found to be less uniform than expected. Beginning May 22, when the wheat was past blooming and the grain was set, cuttings were made daily at the same hour on 42 successive days, about one-half of each cutting being dried on the straw, and the heads being cut from the other half and dried separately. The wheat from each cutting was thrashed and cleaned, "that used for analysis being hand picked to free it from all foreign matter." The number of kernels in 10 gm. of each sample was determined. This shows a quite regular decrease from 3,583 kernels for the first cutting to 246 for the last cutting.

The quantitative method used for separating the proteids was that described in Bulletin 42 of the station (E. S. R., 8, p. 854), except that in the extraction of the gliadin alcohol of 0.9 sp. gr. (about 58 per cent by weight) was used instead of 75 per cent alcohol, as formerly recommended. The nitrogen compounds were determined in each of the 42 samples of wheat ripened on the straw; the nitrogen was determined in the grain of the heads cut from the straw for the first 36 days, and a complete determination of the nitrogen compounds of the third sample of this series was made. These data are tabulated on the basis of dry matter and of total nitrogen, and the differences in composition where the heads were cut from the straw and the grain cured on the straw are given. A summary of the nitrogen compounds for groups of 3 days is given in the following table:

Nitrogenous compounds in wheat at different stages of maturity, in percentages of the total nitrogen.

Period.	Stage of maturity	Gliadin nitrogen.	Glutenin nitrogen.	Edestin and leucosin nitrogen.	Amid nitrogen.
1	A little past bloom; grain set	28.4	44.2	11.9	15.5
2	Berries one-half to full length of ripe grain	34.7	43.1	13.7	8.5
3	Grain coming in milk; lower leaves dying	39.9	37.8	15.1	7.2
4	Grain well in milk	41.9	36.2	15.2	6.7
5	Heads and kernels well developed; thin dough	43.3	35.7	14.7	6.3
6	Grain in dough	45.6	35.6	13.9	4.9
7	Grain in stiff dough; straw becoming yellow at butt.	48.5	35.8	11.4	4.3
8	Straw much yellowed but still decidedly green	50.0	35.9	10.3	3.8
9	Straw still a little green	53.5	32.7	10.4	3.4
10	Wheat fit to cut; berry nearly dry	53.3	31.5	11.8	3.4
11	Grain overripe	51.9	33.2	11.6	3.3
a(11)	do	(52.9)	(32.4)	(11.5)	(3.2)
12	do	53.5	31.1	11.5	3.9
13	do	52.4	32.3	11.1	4.2
14	do	53.0	31.9	11.3	3.8

a Figures in parentheses give average of group, omitting one sample which was irregular.

"When considered in proportion to the whole amount of nitrogen compounds present, there is a large increase in the gliadin from the earliest cutting of the grain until it is ripened. There is a marked but smaller decrease in the proportion of glutenin over the same time and a very rapid falling off in the proportion of amids during the first few days. The changes in the proportion of edestin and leucosin during the entire time of cutting is less marked and more irregular.

"There is a corresponding but less marked change in these same compounds when considered in percentages of the dry matter of the grain.

"The nitrogen compounds in this grain when ripe were in about the following proportions: Amids 1, edestin and leucosin 3.5, glutenin 10, and gliadin 16.

"There was over the period preceding ripening a very appreciable larger percentage of nitrogen in the wheat of heads cut from the straw at the time of the gathering than in that gathered at the same time and dried on the straw, the explanation of which seems to be that the transfer of dry matter from the straw to the grain after cutting was largely one of non-nitrogenous matter.

"When considered in relation to the whole amount of nitrogen compounds present, there was little difference in the proportions of the different nitrogen compounds in the wheat dried on the straw and in that of heads cut from the straw."

To study the changes in the nitrogenous compounds in the endosperm, samples of the wheat from the sixteenth to the thirtieth cuttings were milled in a small roller flour mill provided for the purpose, and the nitrogenous compounds in the flour determined. The results are tabulated on the basis of the total dry matter and of the total nitrogen, and are compared with those obtained for the whole wheat. These showed that the difference between the total nitrogen in the whole wheat and in the endosperm was very appreciably greater in the ripe wheat than in the wheat cut a week or 10 days earlier. Up to about 2 weeks before ripening the gliadin nitrogen formed a greater proportion of the dry matter of the endosperm than of the whole wheat, but from that time until ripening this was reversed, the proportion of gliadin nitrogen being greater in the whole wheat than in the endosperm.

A study was also made of the proximate composition of wheat at different stages. The samples cut at different stages and dried on the straw were analyzed and the results in periods of 3 days, corresponding to the stages of ripeness mentioned in the preceding table, are given as follows:

Proximate composition of wheat at different stages, calculated to dry matter.

Period.	Ash.	Proteids.	Amids.	Fats.	Crude fiber.	Pentosans.	Dextrins.	Sucrose.	Dextrose.	Starch and undetermined.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	4.81	17.80	2.83	4.32	8.69	13.54	2.00	2.95	1.55	41.51
2	4.16	17.30	1.40	3.09	6 96	12.84	3.07	2.80	.64	47.74
3	3.24	15.36	1.01	2.64	5.50	12.28	2.86	2.26	.17	54.68
4	2.52	14.30	.91	2.51	4 56	11.10	2.66	1.94	.08	59 42
5	2.16	13.75	.78	2.31	3.72	9.73	2.26	1.42	.07	63.80
6	2.07	13.15	.56	2.38	3 30	9.66	2.11	1.45	.05	65.27
7	1.82	13.64	.51	2.45	3.10	9.32	1.94	1.45	.05	65.72
8	1.80	14.55	.50	2.59	3.11	8.82	1.75	1.43	Trace.	65.45
9	1.68	15.40	.44	2.60	3.01	8.50	1.72	1.28	.01	65.36
10	1.79	16.24	.50	2 44	3.03	8.41	1.83	1.44	Trace.	64.32
11	1.77	14.96	.44	2.50	3.04	8.08	2.46	1.52	Trace.	65.23
12	1.59	16.59	.61	2.37	2.98	8.16	1.77	1.51	Trace.	64.42
13	1.87	16.56	.62	2.46	3.00	8.33	1.79	1.53	Trace.	63.84
14	1.69	17.26	.56	2.52	2.96	8.63	1.75	1.50	Trace.	63.15

"The proportions of ash, amids, fats, fiber, dextrins and pentosans gradually decreased in the dry matter of the grain from the earliest stages up to ripeness. The proportion of sucrose rapidly decreased for the first 5 periods and was practically constant from then on. The very appreciable quantity of reducing sugar in the earlier periods decreased to a mere trace up to the time of ripening. The proportion of starch rapidly increased up to a week or more before ripening.

"The proportion of total proteids in the dry matter of the grain steadily decreased from the earliest time up to about a week before ripening and gradually increased from then on. This is not in accord with results of Dr. Kedzie[1] in experiments of 2 different years in Michigan, and it is hoped that further information on the subject may be obtained from work now in progress on another year's growth of Arkansas wheat."

Summary of experiments with corn and wheat, 1898 (*Oklahoma Sta. Bul. 36, pp. 4*).—The results of experiments with wheat and corn are briefly stated. Among the varieties of wheat tested Fultz, Red Russian, and Fulcaster gave the best yields, the average for 2 years being 45, 42, and 41 bu. per acre, respectively. Early Red Clawson, Big English, Missouri Blue Stem, Sibley New Golden, Mealy, Crate, and Lebanon averaged from 35 to 40 bu. per acre; and Dietz Longberry, Nigger, Bearded Monarch, German Emperor, Extra Early Oakley, Longberry, Miami Valley, Early Ripe, Saskatchewan, and Valley from 30 to 35 bu. per acre. Genesee Giant was most affected by rust. In general wheat sown September 25 or October 5 gave better returns than wheat sown earlier or later. The results from sowings at the rates of 3, 4, 5, 6, and 8 pk. per acre showed that in general the average yield increased from thinnest to thickest seeding. Rolling the land in addition to harrowing it before seeding produced no appreciable effect.

In general the best results in the experiment with corn were obtained from plantings made March 28, with kernels every 12 in. in rows 3 ft. 8 in. apart; and from plowing about 6 in. deep and subsoiling 4 in. lower. A root-pruning experiment showed that no injury resulted from running a knife 3 in. deep, or running it 6 in. deep 22 in. away from the plants. Where the knife cut 6 in. deep within 6 or 12 in. of the stalk the yield was reduced considerably. The results from different methods of cultivation proved inconclusive. Brazilian Flour corn and Cornucopia yielded 21 and 15 bu. per acre, respectively. In all experiments except the variety test, Adams White Dent corn was grown, and some plats yielded from 40 to 60 bu. per acre.

Experiments with roots and forage crops, F. W. RANE (*New Hampshire Sta. Bul. 57, pp. 127–153, figs. 14*).—This bulletin describes in a popular manner the cultural tests made at the station of various root and forage crops and gives recommendations for their culture. The following crops were grown: Ensilage corn, millets, Brazilian flour corn, teosinte, Kafir corn, millo maize, Jerusalem corn, soy beans, cowpeas, Russian vetch, oats and Canada peas, crimson clover, lupines, serradella, sainfoin, rape, kale, spurry, sunflower, Idaho field pea, sacha-

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[1] Michigan Bd. Agr. Rpt. 1881–82, p. 233; reprinted 1885, p. 121; and Michigan Sta. Bul. 101 (E. S. R., 5, p. 782).

line, giant beggar weed, sugar beets, carrots, ruta-bagas, mangel-wurzels, turnips, and Jerusalem artichokes. The millets, *Panicum crus-galli, P. mileacea, P. italica*, Golden Winter and New Siberian, yielded about 16, 10, 7, 9, and 5 tons of hay per acre, respectively. It was found that soy beans responded readily to fertilizers supplying potash, phosphoric acid, nitrogen, and lime. Of 5 varieties of cowpeas, Southern Yellow Eye produced the best yield—over 18 tons of green material per acre. The average yield of Russian vetch (*Vicia villosa*) was over 13 tons of green fodder per acre. The results with crimson clover have been reported in a former bulletin (E. S. R., 8, p. 586). Thousand-headed kale, sown in spring and cut in August, yielded about 24 tons of green fodder per acre. The yields of the root crops are given in a table.

Forage crops, E. B. VOORHEES and C. B. LANE (*New Jersey Stas. Bul. 130, pp. 1-16, pls. 2*).—The results of experiments with forage crops conducted for 3 years are reported, and the methods used in seeding and the cost and composition of the fertilizers applied are discussed in a popular manner. The following forage crops, arranged in the order of their use during the season, were grown at the station: Rye, crimson clover, red clover, mixed grasses, oats and peas, corn, cowpeas and soy beans, Japanese millet, and barley and peas. The land on which these crops were grown received a general application of 8 tons of barnyard manure per acre annually. In addition to this application the crimson clover, corn, cowpeas, and soy beans received a dressing of 200 lbs. per acre of an even mixture of ground bone, acid phosphate, and muriate of potash; the millets, oats and peas, and barley and peas, an application of 200 lbs. per acre of a mixture of 50 lbs. nitrate of soda, 100 lbs. of acid phosphate, 100 lbs. of ground bone, and 50 lbs. muriate of potash. The cost of the fertilizers for these crops was $2.50 per acre. The rye received a dressing of 100 lbs. acid phosphate and 50 lbs. muriate of potash per acre, applied immediately before seeding. The cost of this application was $1.50 per acre.

The digestible food and its cost of production in the various crops as determined in these experiments is given in the following table, the object of the analysis being to determine the average composition of each crop at the stage best fitted for feeding:

Cost and amount of digestible food in various forage crops.

Kind of crop.	Dry matter per ton.	Digestible food per ton.			Nutritive ratio.	Cost per ton.
		Fat.	Protein.	Carbohydrates.		
Legumes:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		
Crimson clover	322	5.4	49.6	148.4	1: 3.3	$0.61
Barley and peas	316	8.6	45.2	118.4	1: 3.1	1.56
Oats and peas	360	10.8	42.8	160.4	1: 4.4	1.04
Soy beans	385	6.6	34.2	174.0	1: 5.6	1.20
Cowpeas	238	6.0	28.8	119.0	1: 4.6	1.06
Cereals:						
Rye	362	8.8	41.0	205.6	1: 5.5	.68
Broom-corn millet	360	7.6	34.6	171.4	1: 5.5	.73
Italian millet	541	10.6	30.8	295.6	1:10.4	.88
Corn	458	8.2	19.8	287.6	1:15.5	.78
Barnyard millet	269	4.0	18.8	134.2	1: 7.7	.83

Only one sample of barnyard millet was secured, and it is believed that the analysis does not fairly represent its average composition.

The average cost of production was 75 cts. per ton for the cereal crops and $1.33 per ton for the leguminous crops, exclusive of the crimson clover.

A study was made of 2 soiling crop rotations, and the results are reported in detail. Both proved exhaustive to the soil. The method of fertilization followed in the experiments as described above is recommended.

The lodging of grain, JULIEN and DUPONT (*Ann. Agron., 24 (1898), No. 11, pp. 534–548*).—A study was made of the lodging of grain in the experimental fields at Grignon, where 2 plats of wheat lodged June 25 after violent rain and wind storms had prevailed, while the grain on 2 other plats remained intact. The conditions were the same for all these plats. It was found that the lodged grain had been attacked by 2 fungus diseases, *Erysiphe graminis* and *Ophiobolus graminis*, which weakened the stems and caused them to lodge. Of the lodged plants 15 per cent failed to ripen their grain, while of those which remained standing only 1 per cent failed to produce ripened grain. Grain had lodged in previous years on the plats which produced the lodged grain this season, and the authors believe that the spores which remained in the soil germinated under favorable conditions and caused the spread of the disease and the ultimate lodging of the grain. Burning the stubble after the grain has been harvested is recommended as a remedy.

The yield and composition of the lodged and unlodged grain were compared. It was found that wheat and oats were similarly affected by lodging. The composition of the harvested grain from the lodged and the unlodged plats was about the same, but the kernels on the lodged plat were reduced in number and in weight, thus diminishing the yield considerably.

The stooling of grains, B. C. BUFFUM (*Wyoming Sta. Bul. 37, pp. 207–242, pls. 2*).—Experiments to determine the relative tillering of wheat, oats, and barley were carried on at Laramie and at 4 substations in the State for 2 years in succession.

In 1896 seeds were planted 1, 2, 4, and 12 in. apart in rows 3 ft. apart; and in 1897 the experiment was repeated on a somewhat larger scale. In addition to these tests small plats were planted with different amounts of seed per acre to determine results in actual field practice.

The results are tabulated and discussed and also presented graphically. The effects of altitude and irrigation on the stooling of grains are discussed, and some practical hints in grain growing at high altitudes are given.

In general the results show that the number of mature heads produced by each seed varies greatly with the locality and the season, and that the number of heads and the amount of grain produced increases rapidly with the space given each seed. It was found that plants

grown at wide distances apart produced shorter straw and a greater proportion of straw to grain than when thickly planted.

"Where given too much room many more stems are produced than will mature heads. On account of the continuous growth from the crown of the stool during the summer the grain is late in maturing, does not fill well, and as a whole produces light, inferior grain.

"Larger heads are produced upon grain planted more than 1 in. apart, although all the heads may not be as uniform in size. The number of seeds in the largest heads produced increased rapidly with the distance between plants.

"While more grain will be produced by each seed when planted at greater distances than 1 in. apart, the actual amount of grain will be less for the area of land used . . . A study of our experiments seems to indicate that in farm practice sowing seed so plants will be secured about 1 in. apart in the drill will produce the largest yields per acre of wheat or barley, but that oats should probably be planted a little thicker than this."

The author concludes from his investigations that if 80 per cent of the seed germinates and it is sown in drills 8 in. apart, it requires 78 lbs. of wheat weighing 61 lbs. per bushel, 86 lbs. of barley weighing 53 lbs. per bushel, and 61 lbs. of oats weighing 40 lbs. per bushel to plant an acre with plants 1 in. apart in the row.

At Laramie in 1897 50 and 70 lbs. of wheat per acre gave as large yields as greater amounts of seed, but where 100 lbs. per acre were sown the grain weighed more per bushel and ripened earlier. There was little difference in the yield of barley plats sown at different rates per acre, but the plats with the heavier seeding ripened earlier and produced better grain. Oats seeded at the rate of 60 lbs. per acre gave the best yield. The thinly seeded plats failed to ripen the grain fully. At Sheridan in 1897 the best yields were obtained from sowing 50 to 70 lbs. of wheat, 70 to 80 lbs. of barley, and 80 to 100 lbs. of oats per acre. The results obtained at the 5 different places indicate that barley has the greatest tillering power, followed by wheat and oats in the order mentioned.

"In addition to the importance of thicker seeding at high altitudes to shorten time of ripening, our experiments indicate that upon like soils and under similar climatic conditions, wheat, oats, and barley actually produce less matured heads and less grain with increase of altitude.

"Grain under irrigation produced more matured heads per stool and more grain than where raised without irrigation. . . .

"The amount of grain produced on different amounts of seed per acre varies in different seasons. On account of increased tillering light seeding (from 30 to 50 lbs. per acre) may produce as much grain as would a larger amount of seed; but when more seed is sown the difference in weight of the grain per bushel, along with shorter period of maturity and evenness in ripening, may more than pay for the extra seed used.

Trials with orchard grass, F. AND K. HANSEN (*Landmansblade, 31* (*1897*), *No. 10, p. 134*).—Experiments were conducted for 10 years at 3 Danish experiment stations for the purpose of ascertaining the amount of hay obtained from orchard grass, the seed of which had been obtained from different sources. The average results at the 3 stations are com-

pared in the following table, the yields from American seed being placed at 100:

Culture tests with orchard grass.

Source of seed.	Location of experiment station.		
	Tystofte.	Askov.	Lyngby.
America (United States)	100	100	100
Europe (Denmark, Germany, France, Sweden)	98	102	97
Australia and New Zealand	78	85	74

—F. W. WOLL.

Influence of permanent grass culture on the nitrogen content of the soil compared with that of other crops, T. A. TUXEN (*Norsk. Landmandsblad, 17 (1898), No. 13, p. 142*).—The experiments were conducted at the State Agricultural College at Copenhagen to determine the influence of continued grass and barley culture and crop rotations on the nitrogen content of the soil. The plats were divided into 3 series; the first was left unmanured, the second received regular applications of complete commercial fertilizers, and the third was regularly manured with barnyard manure. The quantity of nitrogen in the soil was determined after the experiment had been in progress 22 and 30 years. The average results are given in the following table:

Nitrogen per hectare in the upper twenty centimeters of soil on plats under different systems of cropping.

	Plats cropped for 22 years.			Plats cropped for 30 years.		
	No fertilizer.	Commercial fertilizer.	Barnyard manure.	No fertilizer.	Commercial fertilizer.	Barnyard manure.
	Kgs.	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*
Continuous grass culture	4,931	5,131	5,842	4,638	5,010	6,793
Continuous barley culture	3,578	3,639	4,596	3,470	3,403	4,804
Cropping in rotation	4,407	4,582	5,493	5,025	5,185	6,164

The results show the beneficial effects of grass crops on the nitrogen content of the soil compared with continuous barley culture, and rotative cropping. The grass plats which received commercial fertilizers or which were left unmanured gave less favorable results after 30 years of cropping than the plats on which various crops, including beans, were grown in rotation. It is concluded that commercial nitrogenous fertilizers do not increase the nitrogen content of the soil to the same extent as barnyard manure.—F. W. WOLL.

Field experiments with fertilizers in 1897 (*Ohio Sta. Bul. 91, pp. 291–326, dgms. 2, map 1*).—The plan of these experiments, the soils upon which they were conducted, and the results obtained up to the end of 1896 have been described in previous bulletins (E. S. R., 8, p. 576; 9, p. 747). In this bulletin the results obtained in 1897 are tabulated and discussed and conclusions drawn.

It was found that for the crops under test, corn, oats, wheat, clover, timothy, and potatoes, and for the soils upon which they were grown, phosphoric acid was the most important fertilizer constituent, with nitrogen and potash following, in the order named. The largest increase in yield was obtained with the complete fertilizers containing all these constituents, but it is believed that the use of nitrogen and potash in the same proportion to phosphoric acid in which they are found in the crops is unnecessary under present conditions, and that the quantity of phosphoric acid should considerably exceed that of either nitrogen or potash in applications for corn, oats, or potatoes, while for wheat the proportion of nitrogen may closely approximate that of phosphoric acid. Dissolved boneblack seemed more effective than raw bone meal or acid phosphate; basic slag stood next to it in effectiveness.

"Nitrate of soda is apparently the most effective carrier of nitrogen in common use as a fertilizer. . . . Slaughterhouse tankage . . . is probably a less effective carrier of nitrogen than nitrate of soda, but the cost of nitrogen in unmixed tankage when due allowance is made for the phosphoric acid carried by the tankage is so much less than in nitrate of soda that tankage becomes a much more economical source of nitrogen to the Ohio farmer than nitrate of soda.

"This advantage in tankage disappears, however, when it is purchased in the ordinary factory-mixed fertilizer, since the price at which such fertilizers are generally sold brings the cost of their nitrogen to a higher figure than its necessary cost in nitrate of soda."

The results further show that the phosphoric acid of finely ground bone meal and tankage is as effective as the available phosphoric acid of acid phosphate, and that when these materials are finely ground no further treatment with sulphuric acid is necessary to render their phosphoric acid available.

The fertilizing constituents of barnyard manure acted more slowly than those of commercial fertilizers, but as they cost much less in manure it became the cheapest fertilizer. Applying manure to the surface instead of plowing it under proved to be most advantageous.

"The increase from fertilizers in these experiments was unusually large in 1897, this being the first season of the experiments at this station in which the cereal crops have given a general increase sufficient to cover the cost of fertilizers. In the average of the 4 seasons . . . the value of the increase of crop has only equaled the cost of the fertilizer in a few instances. The most profitable increase in the average is found in the crop which has received a fertilizer mixed from tankage and acid phosphate, with a small addition of muriate of potash, used only on corn and wheat."

Third report on potato culture, I. P. ROBERTS and L. A. CLINTON (*New York Cornell Sta. Bul. 156, pp. 175–184*).—This work is in continuation of experiments now in progress for 4 years. Previous results have been reported in former bulletins (E. S. R., 9, p. 345 and p. 1044). The results for 1898 are reported, and the soil conditions, the various operations, and other details of the experiment are described. Directions for making Bordeaux mixture are given, and the ferro-cyanid of potassium test for the purpose of determining the amount of lime

required is recommended. The records of the experiment for this season were as follows:

Records of potato plats for 1898.

Variety.	Date of planting.	Number of cultivations.	Number of sprayings.	Date of digging.	Yield per acre.
					Bushels.
Endurance	May 10	6 level	7	October 18	398.6
Carman No. 3	do	6 level	7	do	344.8
Do	do	3 level	7	do	303.3
Do	do	3 level	7	October 17	340
Do	do	3 hilled	7	do	327.5
Do	do	6 level	7	September 29	310.5
Do	do	3 level	7	do	269.6
Do	do	3 level	7	do	269.8
Do	do	6 level	7	do	213.3
Do	do	6 level	0	do	206.1
Rose of Sharon	do	6 level	7	do	118.6
Endurance	do	6 level	0	do	232

The following conclusions are based on the results obtained during 4 years:

"Early planting of potatoes and frequent tillage to conserve moisture will ordinarily give best results, [but] necessitates vigorous spraying with Bordeaux mixture and Paris green to protect the foliage from blight and beetles.

"Success with potatoes depends largely upon the preparation given the soil before the potatoes are planted. Plowing should be deep and at the time of planting the soil should be mellow and loose.

"On soils which are likely to be affected seriously by droughts, it is especially important that the potatoes be planted early and deep, and the tillage should be frequent and level.

"On soils which are not well drained, either naturally or artificially, and on clay or clay-loam soils, potatoes may be planted somewhat shallow and slight hilling may be practiced with benefit.

"Harrowing the land after the potatoes were planted and before the plants appeared produced marked beneficial results. From 6 to 7 cultivations have given best yields."

Variety test of potatoes, C. O. FLAGG, G. M. TUCKER, and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 381–388*).—The method of carrying on the test is described and the results are given in tabular form. Brief descriptions are given of the new varieties used in the experiment.

In 1896, 11 varieties of potatoes were tested, and the following season 5 of these varieties were given a further trial and 10 new varieties were grown in addition. Enormous, a late variety, produced the largest total yield and marketable crops in both seasons.

Cultural experiments with potatoes, C. O. FLAGG, G. M. TUCKER, and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 322–351*).—The results reported show the effects on the yield of potatoes (1) of spading the soil to depths varying from 4 to 18 in., (2) of very thorough and less thorough cultivation, and (3) of planting at varying distances. The experiments were conducted for 2 years in succession. The aver-

age results for 2 seasons obtained with plats spaded at different depths are given in the following table:

Average yields of potatoes from plats spaded to different depths in 1896 and 1897.

Depth of spading.	Yield per acre.		
	Total yield.	Large tubers.	Small tubers.
	Bushels.	*Bushels.*	*Bushels.*
4 inches	288.38	158.85	129.52
8 inches	297.63	186.70	110.92
12 inches	286.34	180.32	106.37
15 inches	289.89	187.55	102.33
18 inches	300.22	187.34	112.88

In the cultivation tests the soil of a number of plats was worked to a depth of about 2 in. 10 times the first year and 8 times the second, while an equal number of plats were cultivated 4 in. deep 11 times in 1896 and 10 times in 1897. The average results show that less thorough cultivation gave an excess of 4.75 bu. per acre in total yield and 6.68 bu. in large tubers over more thorough cultivation, while the latter gave an excess of 2.1 bu. of small potatoes per acre as compared with the former.

In 1896 seed pieces uniform in size were planted 9, 12, and 16 in. apart in drills 24 and 30 in. apart. After deducting the seed from the yield of large tubers the plants grown 9 in. apart in the row yielded at the rate of 192.99 bu. per acre of large tubers or 6.52 bu. more than the 12 in. planting and 19.56 bu. more than the 16 in. planting.

In 1897 the results were the reverse of those obtained in 1896. The yield of large tubers increased with the distance between plants in the drill. The average yield of large tubers was 36.29 bu. per acre more in drills 24 in. apart than in drills 30 in. apart.

Further tests of seed potatoes grown one or more years in Rhode Island from northern-grown seed tubers, C. O. FLAGG and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 374–380*).—These tests are in continuation of work formerly reported (E. S. R., 9, p. 943). A description of the experiments is given and the results for the entire series are reported in tables. The author summarizes the results as follows:

"The average yields of 7 varieties of potatoes, home-grown respectively 2, 3, and 4 years from seed tubers, produced in Aroostook County, Maine, show great uniformity. The heaviest average total yield was in the second-year crop, while the heaviest yield of large potatoes was in the fourth-year crop.

"The average weight of the tubers produced was lowest in the case of the second-year crop and highest in the fourth-year crop. The percentage of large tubers by weight was greatest in the case of the fourth-year crop.

"The variety producing the heaviest crop gave the greatest yield secured in the test as the product of the fourth-year crop, viz, 245.87 bu. per acre; and the variety which gave the lowest yield, 155.84 bu. per acre, produced the smallest yield of the test as the product of the fourth-year crop.

"Varieties which produced the larger yields gave increased crops the longer the seed tubers had been home-grown, while those which produced smaller crops gave decreasing yields the longer the seed had been home-grown."

The potato crop in the rotations, C. O. FLAGG, G. M. TUCKER, and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 389–393*).—Six rotations are in progress in 2 of which potatoes are planted on clover sod while in the other 4 they are planted after corn. The results for the seasons of 1896 and 1897 are reported. The average results indicate that when potatoes are planted on a clover sod a better yield is obtained than when the crop is planted after corn. "The growth of potatoes upon the clover-sod plats was very rapid and vigorous, indicating the presence in the soil of considerable available nitrogen."

External indication of an increase of solanin in potatoes, SCHNELL (*Apoth. Ztg., 13 (1898), p. 775; abs. in Chem. Ztg., 22 (1898), No. 95, Repert., p. 291*).—In examining potatoes which had caused wholesale sickness among soldiers, the author found small gray spots which were richer in solanin than the white part of the potato. Whether these gray spots were due to the action of fungi or bacteria he was unable to determine. The potatoes had sprouted vigorously early in June, and contained about 6 times the normal amount of solanin.

Fertilizer experiments with potatoes, C. O. FLAGG, G. M. TUCKER, and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1897, pp. 352–373*).—The fertilizer experiments with different amounts of nitrogen, phosphoric acid, and potash for potatoes made in 1896 and 1897 are described and the results tabulated and summarized. The total rainfall for May, June, July, and August is reported as 14.71 in. in 1896 and 19.04 in. in 1897. The standard fertilizer used in these experiments as a base upon which comparisons were made consisted of muriate of potash, dissolved phosphate rock, and nitrate of soda. It was applied at the rate of 1,678.51 lbs. per acre, and contained 3.2 per cent nitrogen, 8 per cent of available phosphoric acid, and 6.48 per cent of potash. The standard application was the same for both seasons, but the amount of the different elements of plant food varied on certain plats, being one-half, 2, and 3 times the amount furnished in the standard fertilizer application. When the amount of an element in the application was increased or decreased the other elements were supplied as in the standard fertilizer. The materials used for fertilizers and the amount of the standard applications are given in the following table:

Fertilizers used and the standard application of each.

Fertilizer.	Standard application per acre.	
	1896.	1897.
	Pounds.	*Pounds.*
Muriate of potash	207	214.89
Sulphate of potash	209	226.51
Dissolved phosphate rock	1,080	374.10
Nitrate of soda	392	343.39
Dried blood	452	438.50

The average results for the 2 years show that the largest total crop and the largest yield of large tubers was produced when the supply of potash was half sulphate and half muriate. The standard application of muriate of potash gave a better average yield of total product of large and small tubers than an application containing double the amount of potash. The tests with different amounts of phosphoric acid resulted in the smallest average yield from the standard application, the next largest from the use of 3 times the amount of phosphoric acid furnished in the standard fertilizer, and the largest yield—an increase of 15.93 bu. per acre of marketable potatoes over the standard application—from a fertilizer which contained twice that amount of phosphoric acid. The amount of phosphoric acid which proved the most effective cost $6.29 more per acre in 1897 than the amount in the standard application. The average results in the comparison of nitrate of soda and dried blood as carriers of nitrogen show that nitrate of soda was most effective, followed by dried blood, and an application of half of each in the order mentioned. The difference in the average of the crops of the nitrogen plats was not great, the extremes in the marketable tubers being 165.35 and 173.4 bu. per acre.

Trials with fish guano for sugar beets, P. HANSSON (*Meddel. K. Landtbr. Styr., 1897, No. 42, pp. 149, 150*).—Fish guano and nitrate of soda were applied in corresponding quantities on 6 plats, 3 of which received fish guano and 3 nitrate of soda. On clay humus the relation of the effect of nitrate of soda to that of fish guano was as 100 to 80; on moist humus, as 100 to 90, and on dry, porous, and sandy humus as 100 to 120.—F. W. WOLL.

Fish guano vs. nitrate of soda for sugar beets and for barley, C. O. HAMMARGREN (*Meddel. K. Landtbr. Styr., 1897, No. 42, pp. 145, 146*).—Comparative experiments with fish guano and nitrate of soda for sugar beets and for barley were made on eighth-acre plats. The results obtained are given in the table:

Results of fertilizer experiments with sugar beets and barley.

Sugar beets.			Barley.		
Fertilizers per hectare.	Yield per hectare.		Fertilizers per hectare.	Yield per hectare.	
	Beets.	Tops.		Grain.	Straw.
	Kgs.	*Kgs.*		*Kgs.*	*Kgs.*
Superphosphate 600 kg., fish guano 300 kg., nitrate of soda 200 kg.	31,200	24,576	Superphosphate 400 kg., fish guano 75 kg., nitrate of soda 50 kg.	1,888	2,576
Superphosphate 600 kg., fish guano 600 kg.	31,360	23,040	Superphosphate 400 kg., fish guano 150 kg.	1,856	2,520
Superphosphate 600 kg., nitrate of soda 400 kg.	34,080	28,160	Superphosphate 400 kg., nitrate of soda 100 kg.	2,040	2,720

—F. W. WOLL.

Report of the agriculturist, H. E. STOCKBRIDGE (*Florida Sta. Rpt. 1898, pp. 11–21*).—In this report the station farm is described and contemplated experiments are outlined. Bulletin No. 44 of the station is reviewed (E. S. R., 10, p. 347). Directions

are given for making a "simple sirup tester," an instrument for determining the variations in density or the thickness of sirup for the use of ordinary workmen.

The necessity of practical field tests and the methods of conducting them, LOGES and VIBRANS (*Jahrb. Deut. Landw. Gesell., 13 (1898), pp. 65–74*).—A paper read before the German Agricultural Society.

Beet culture and beet seed production, P. DOERSTLING (*Bl. Zuckerrübenbau, 6 (1899), No. 4, pp. 57, 58*).—A brief note referring to some of the results of interest in this connection obtained by several investigators.

Time of harvesting beet seed, NOBBE (*Jahrb. Deut. Landw. Gesell., 13 (1898), pp. 189–197, fig. 1*).—This paper discusses the practices of a number of prominent beet seed growers and gives the results of germination experiments with beet seed carried on in 1896 and 1897. The author concludes from the results that under favorable weather conditions it is best to allow the seed to ripen in the field.

The importance of growing cereals and catch crops, STIEGER (*Fühling's Landw. Ztg., 47 (1898), No. 20, pp. 762–764*).—The importance of cereals and catch crops in rotations is discussed.

Cotton and its by-product (*Jour. Jamaica Agr. Soc., 3 (1899), No. 3, pp. 133–137*).—A popular article on the cultivation and uses of cotton.

Flax culture in the Russian Baltic provinces and in Germany, SCHINDLER (*Jahrb. Deut. Landw. Gesell., 13 (1898), pp. 177–183*).—A paper comparing the cultural methods of the two regions.

Hop culture, REMY (*Fühling's Landw. Ztg., 47 (1898), No. 19, pp. 730–733, 756–758*).—An article on the use of hops for brewing purposes. The author considers the chemical composition and the aroma of hops and discusses the methods of harvesting and drying.

Investigations on the effects of drying hops by fire heat, T. REMY (*Wchnschr. Brau., 14 (1897), No. 53, pp. 682, 683*).

Report on the culture experiments of the German potato experiment station in 1898 (*Sächs. Landw. Ztschr., n. ser., 21 (1899), No. 8, pp. 81–87; Deut. Landw. Presse, 26 (1899), No. 19, pp. 196, 197*).—A report on cooperative tests of new varieties of potatoes on 26 experiment fields located in different parts of Germany.

Variety tests of potatoes, 1898, TANCRÉ (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 10, pp. 166–171*).—Tabulated results of cooperative variety tests of potatoes are given, with brief notes on the different experiment fields. Brief descriptions are given of some of the varieties.

The culture of potatoes on the experimental field at Grignon in 1896 and 1897, J. CROCHETELLE (*Ann. Agron., 24 (1898), No. 1, pp. 39–48*).

Experiments with potatoes, F. DESPREZ (*Jour. Agr. Prat., 1899, I, No. 9, pp. 314–316*).—A résumé of the results of variety tests, distance experiments, and experiments in hastening the maturity of late varieties is given.

Ruta-bagas, H. L. DE VILMORIN (*Jour. Agr. Prat., 1899, I, No. 9, pp. 319–323, pl. 1*).—This article discusses the origin and history of the ruta-baga, describes a number of different varieties, and gives directions for the culture of the crop.

Breeding Pirnaer rye and investigations on rye breeding in general, STEGLICH and FISCHER (*Jahrb. Deut. Landw. Gesell., 13 (1898), pp. 198–210*).—This paper describes the method in which the Pirnaer rye was originated, and gives the results of experiments in growing rye from different colored grains and from seed taken from plants with different numbers of internodes. It was found that grains grayish green in color were richer in nitrogen than reddish yellow or dark brown grains.

Sugar cane from seeds in the Straits Settlements, C. CURTIS (*Agr. Bul. Malay Peninsula [Bot. Gard. Dept. Straits Settlements], 1898, No. 8, pp. 219–221, pl. 1*).—A popular article on growing sugar cane from seeds.

Preparation of seed beds for tobacco plants (*Würt. Wchnbl. Landw., 1899, No. 10, p. 142*).—A popular note.

Culture and fertilizer experiments with tobacco, DETTINGER (*Ztschr. Landw. Ver. Rheinpreussen, 15 (1898), No. 31, pp. 281–283*).—The results of cooperative experi-

ments are reported. The plats on which the tobacco was grown were bedded and this method of culture gave good results. The use of commercial fertilizers gave as good results as the use of barnyard manure. The use of guano proved detrimental to the quality.

Report on variety tests, EDLER (*Jahrb. Deut. Landw. Gesell., 13 (1898), pp. 184–189*).—This report contains brief notes on the results of tests with 13 varieties of spring wheat, 11 of winter wheat, 23 of square-head wheat, and 1 variety of lupines.

The relation of crop rotation to fertilization, SCHULTZ and MAERCKER (*Jahrb. Deut. Landw. Gesell., 13 (1898), pp. 31–47*).—A paper read before the German Agricultural Society.

Green manuring and its extension in Bavaria with reference to soil, climate, and other conditions, SCHNIDER (*Vrtljschr. Bayer. Landw. Rath, 3 (1898), No. 4, pp. 459–478*).—This article discusses the value of various plants for green manuring and suggests 8 different crop rotations for the improvement of soils.

Green manuring and fallowing on heavy soils, W. EDLER (*Fühling's Landw. Ztg., 47 (1898), No. 22, pp. 841–847; 23, pp. 870–880*).—Comparisons of green manuring and fallowing on heavy soils were made and the results are here given in tables and discussed. In general the results were in favor of fallowing, even when peas were used for green manuring. The author believes fallowing preferable to green manuring on heavy soils, as sowing of fall catch crops is often unsuccessful and as these soils are usually not poor in nitrogen.

Report on fertilizer experiments in 1897–98, TANCRÉ (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 8, pp. 132–135*.)—The results of cooperative fertilizer experiments are given.

HORTICULTURE.

Garden lettuce and its cultivation, L. F. KINNEY (*Rhode Island Sta. Rpt. 1897, pp. 270–285, figs. 8*).—In this article the author speaks of the favorable location and climate of Rhode Island for lettuce growing, and discusses the modification of form of garden vegetables due to cultivation. The frequent failure of lettuce to head is attributed to the "inability of the plants to absorb or to assimilate an adequate amount of nutritive substances. The former is usually due to an insufficient amount of available fertilizing ingredients in the soil, and the latter to an insufficient amount of light."

The cultivation of lettuce in the open air is considered. "The ordinary garden fertilizers are adapted for the production of lettuce, but two or three times as much of them should be applied as is necessary for the growth of beets, cabbages, and most other garden vegetables." The development of lettuce cultivation under glass during the last 50 years is sketched. Directions are given for starting the plants, preparing the soil, and for the general care of the crop, especially in regard to temperature, watering, and diseases and injuries. The following varieties are the ones generally grown in Rhode Island: White-seeded Tennis Ball or Boston Market, Big Boston, and another variety resembling the Big Boston. The preparation of lettuce for market is also considered.

Classification and description of the varieties of garden lettuce, L. F. KINNEY (*Rhode Island Sta. Rpt. 1897, pp. 286–316, figs. 28*).—The author believes that the characters of such plants as the garden lettuce

are sufficiently permanent to warrant a systematic classification of the varieties, and that "where both characters and names are associated together for long periods, a systematic classification is just what is needed to obviate confusion." Over a thousand plantings with seeds from different sources were made at the station. Of the kinds of lettuce in existence none, in the opinion of the writer, satisfactorily fulfills the requirements of a forcing variety. Sixty-nine varieties of lettuce are described and classified according to certain botanical characters, as the margin of leaves near the apex, the length of leaves as compared with the width, the color of leaves and seeds, the habit of leaves in regard to head formation, and the apex of leaves. An analytical key to the varieties is given.

Some experiments in forcing head lettuce, S. A. BEACH (*New York State Sta. Bul. 146, pp. 151-179, pls. 4*).—Tests of various soils and fertilizers for forcing head lettuce were carried on during three winters. The forcing house is described and the general treatment of the crops is given with considerable detail. Salamander lettuce was used in the first test and Rawson New Hothouse in the succeeding tests. At first a soil mixture, which had been used for forcing lettuce with good results, composed of 3 parts rotted clay loam sod, 1 part sand, and 1 part stable manure, was compared with soils differing from it only in containing various amounts of sand. In later tests the percentages of sand and clay loam in the soil mixtures were still further varied, the sand in one case and the loam in another being omitted entirely. In some tests a light, sandy loam was compared with the clay loam as a basis of soil mixtures. The amounts of stable manure were varied somewhat in the different tests. Commercial fertilizers in varying amounts were tested in some of the soil mixtures, both in combination with stable manure and alone.

Several tables are given in which are presented such data as the percentages of the different ingredients of the various soil mixtures, the fertilizer elements of the various mixtures and soils used as basis of the mixture, the mechanical elements of the soil in the mixtures, the amounts of fertilizers employed, the time required for the germination of the seeds, the percentage of germination, the size of seedlings, the time required for plants to mature, the average weight of heads, the percentage of marketable heads, the amount of tip burn, the texture, appearance, and firmness of heads, etc.

The author gives the following summary of results:

"The clay loam with a heavy application of stable manure gave the best results. The light, sandy loam with heavy application of stable manure was least satisfactory.

"On pure sand with a good dressing of stable manure the lettuce made a vigorous growth, but the heads were less firm and the texture more delicate than with the lettuce which was grown on the clay loam. . . .

"On clay loam mixed with 15.5 per cent stable manure by weight a slight increase in growth followed the use of nitrate of soda, but with double this application of manure practically no advantage followed the use of nitrate of soda, either on the clay loam or on the sandy loam.

"No advantage was gained either on the clay loam or the sandy loam from the addition of sulphate of potash and acid phosphate when the soils had already received a heavy application of stable manure.

"Excellent lettuce was produced on the sandy loam by using commercial fertilizers with no stable manure.

"A heavy application of stable manure to the sandy loam put the soil in poor mechanical condition and a crop of inferior lettuce resulted.

"The mechanical condition of the clay loam was improved by a heavy application of stable manure. This mixture produced much better lettuce than was grown on the clay loam where commercial fertilizers were used instead of stable manure."

Pea canning in Delaware, G. H. POWELL (*Delaware Sta. Bul. 41, pp. 16, figs. 5*).—This bulletin treats the subject from the commercial point of view. Directions are given for the culture of peas, especially for the canning factory market, and several details of factory manipulation are given.

The pea-canning industry is of considerable horticultural importance in southern Delaware, representing in 1898 about 2,000 acres of land devoted to the growing of the vines, with a product of 144,000 cases. The varieties of peas most largely used for canning are Alaska, Blue Beauty, and French Canner. Advance and Market Garden are canned to a less extent. Three general systems of sowing are in vogue among growers—broadcasting, the 18-inch drill, and the wide-row systems.

The most troublesome enemy of the growing plants is said to be the sunscald (pea blight, *Ascochyta pisi*), a fungus which attacks the plants just before the blossoming period. "It is possible to infect new ground with the fungus where the pea-vine compost is spread on land that is to precede the pea crop, and our observation has led to the conclusion that the disease is most severe on land used successively for the pea, or on new land which has been treated with the pea-vine compost." Rotation of crops is the fundamental corrective for the trouble.

As to the yield, a fair average return for the majority of growers is 450 to 750 lbs. of shelled peas per acre, worth from $18 to $30.

Ginseng—its nature and culture, H. GARMAN (*Kentucky Sta. Bul. 78, pp. 125–156, pls. 10, figs. 2*).—A statement is given of the production and exports of the roots of this plant since 1821, and its history in the State is reviewed at some length. Its use in medicine is commented upon, and a partial analysis of the dried roots, as published in the Annual Report of the station for 1892, is quoted as follows:

Composition of ginseng roots.

	Crude ash.	Nitrogen.	Phosphoric acid.	Potash.	Lime.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Roots	5.278	1.660	0.535	0.776	0.856
Ash			10.140	14.700	10.140

The botany of the species is treated at considerable length and directions given for the cultivation of the plant. The price per pound is

given for different counties in the State, in which it appears that the price varies from $1 to $4 per pound for dried roots.

Impressions of our fruit-growing industries, L. H. BAILEY (*New York Cornell Sta. Bul. 153, pp. 111-129, fig. 1*).—The bulletin gives a summary of 5 years' study of the actual experiences of fruit raisers in New York to determine the underlying reasons for some of the successes and failures in fruit growing.

"As a result of the inquiries there have appeared, by various persons, 34 bulletins, covering most of the fruits which are commercially grown in the State. In the progress of these investigations it became apparent that there are greater problems in our fruit growing than those of soil and insects and diseases; that fruit growing is profitable or not, in the long run, in proportion as it meets the general requirements of trade and conforms to the agricultural status of the time. It became apparent, also, that even the immediate problems of fertilizers, tillage, and handling of a plantation can not be fully understood from mere scientific investigations at a given place. The investigator must correlate and compare the results of actual fruit growing in many places and under many conditions to be sure that he arrives at broad and sound conclusions, or at principles."

The tendency in this country to grow but a few varieties is thought to be due to the fact that most American fruit growers are raising fruit for the general market, which requires uniformity of product. The author believes that the tendency is to go too far in the reduction of varieties, thereby reducing fruit growing to a single ideal and increasing competition in one line.

The following are given as the most general causes of barrenness of orchards, stated approximately in order of frequency and importance: "(1) Lack of good tillage, particularly in the first few years of the life of the plantation; (2) lack of humus and fertilizer; (3) uncongenial soils and sites; (4) lack of systematic annual pruning; (5) lack of spraying and of attention to borers and other pests; (6) bad selection of varieties; and (7) trees propagated from unfruitful stock."

Two experiments with fertilizers are reported. An apple orchard at Lockport was fertilized in August, 1894. The orchard consisted of Baldwin and Greening trees 25 years old and was situated on hard, dry, light clay loam and had been in sod for some time. The trees were unproductive, but looked better than the majority of trees. Some trees received nitrate of soda, others muriate of potash, others sulphate of potash, and others both sulphate and muriate of potash, the materials being scattered as far as the spread of the limbs and lightly plowed under. Tillage was kept up in succeeding years. The first results were seen in 1896, when the trees fertilized with nitrate had much darker foliage, were more vigorous, and produced more fruit than the other trees. In 1897 these trees were still superior to the others, but the difference was not so marked. In 1898 no effect of the fertilizers could be seen.

Another fertilizer test was begun in 1894 in an orchard of Baldwin and King apples near Ithaca. The trees were 25 years old, had been in sod since the first 3 years, but had been well top-dressed with stable

manure for several years, and were in good bearing condition. The orchard was plowed in the fall of 1894 and spring of 1895 and given clean tillage afterward. At the later date sulphate of potash was applied at the rate of 750 lbs. per acre, and in the spring of 1896 the orchard was given a heavy dressing of muriate of potash. In 1895 the apples on the treated trees were larger and from 7 to 10 days later than those on untreated trees. In 1896 the fertilized trees had an unusually dark-colored and vigorous foliage and produced about twice as much fruit as the other trees, the apples being larger, later, and lighter colored. The greater yield was not due to more profuse blossoming, but to less loss from the dropping of fruit. To determine whether the results were due to the cultivation or to the fertilizers, another plat in the orchard was tilled from 1896 to 1898 without fertilizers, and another plat was left in sod, but top-dressed in June, 1896, with 750 lbs. of muriate of potash per acre, and in August, 1897, with 750 lbs. sulphate of potash per acre. The plat which had been cultivated and fertilized since 1894 was continued in cultivation and given sulphate of potash in August, 1897, at the rate of 750 lbs. per acre. The plat receiving cultivation alone and the one receiving fertilizers alone showed no effect of the treatment either in 1897 or 1898. The plat which received both cultivation and fertilizers continued to show better foliage and to produce more, larger, and later fruit than the remainder of the orchard, though the differences were less marked in 1897 than in 1896 and very small in 1898.

The bulletin also discusses the advantages of sod and of clean cultivation, the value of spraying, etc.

Report of the Russian Apple Nomenclature Commission, August 30–31, 1898, N. E. HANSEN (*Minneapolis, 1898, pp. 10*).—This is the report of the first meeting of a commission appointed by the State Horticultural Societies of Minnesota, Iowa, Wisconsin, and South Dakota to revise and simplify the nomenclature of the imported Russian apples. It is well known that among a great number of these are found many well-defined groups or "families." An attempt is made to distinguish these. "The varieties here grouped as members of the same families, while in a few cases differing somewhat in characteristics of tree, are so nearly identical in fruit that for exhibition and commercial purposes they are practically the same and should be so considered." Each group is designated by the name of its most promising variety, which is carefully described. The varieties belonging to the respective groups are enumerated, and incorrect nomenclatures are indicated. The following groups are established: Hibernal, Duchess, Longfield, Charlamoff, Romna, Cross, Christmas, Antonovka, Anisim, Golden White, Repka Malenka, Yellow Sweet, Transparent, and Anis.

In addition to the above, descriptions of the following varieties, which have attracted special attention in the Northwest, were adopted and are published: Long Arcade, Bode, Lubsk Queen, Lowland Raspberry,

Ostrakoff, Vargulek, Sweet Longfield, Beautiful Arcade, Zuzoff, and Arabskoe.

Chemical studies of Oregon fruits: Cherries, G. W. SHAW (*Oregon Sta. Bul. 55, pp. 12*).—This bulletin is a report of progress in the chemical studies of Oregon fruits which was begun in 1896 (E. S. R., 9, p. 753). The cherries grew on the ordinary gray basaltic loam of the Willamette Valley, the average composition of which is given. All were fully ripe when analyzed. Brief notes are given on each variety.

The following table shows the results:

Composition of Oregon cherries.

Variety.	Whole fruit.				Flesh.						Juice.	
	Average weight.	Flesh.	Pits.	Sugar.	Juice.	Pulp.	Water.	Protein.	Sugar.	Ash.	Acid.	Sugar.
	Gms.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Lincoln	4.40	95.45	4.55	8.43	89.53	10.47	82.35	......	8.83	0.73	......	9.81
Windsor	5.50	95.27	4.73	7.37	87.98	12.02	82.62	......	7.74	.55	0.48	9.31
May Duke	4.15	94.46	5.54	7.30	88.90	11.10	84.45	......	7.73	.58	......	8.64
Black Tartarian	5.64	94.86	5.14	11.02	85.55	14.45	83.87	1.06	11.62	.53	.32	13.55
Early Richmond	4.19	96.42	3.58	10.05	91.73	8.27	84.80	1.13	10.42	.55	.64	11.36
Seedling	2.85	91.23	8.77	10.40	88.99	11.01	80.65	1.00	11.40	.82	.16	12.81
Transparent	5.36	95.90	4.10	10.64	91.13	8.87	86.00	.79	11.10	.46	.28	12.18
Centennial	5.12	92.78	7.22	12.22	80.00	20.00	76.91	.70	13.17	1.00	.80	16.46
Governor Wood	5.94	......	......	......	......	......	81.01	1.20	12.42	.71	.64	......
Elton	5.74	90.90	10.10	11.43	......	......	79.00	1.00	12.58	.60	.16	......
Lewelling	4.79	92.31	7.69	11.36	86.00	14.00	74.72	1.00	12.31	......	.16	14.30
Rockport Bigarreau	7.79	93.35	6.65	11.78	80.00	20.00	78.65	.84	12.62	.66	.24	15.77
Royal Ann	7.26	94.13	5.87	12.85	86.00	14.00	81.29	.88	13.76	.68	.82	16.00
Average	5.29	93.92	5.32	10.40	86.35	13.09	81.25	.91	11.21	.53	.43	12.29

The results are compared with those obtained at the California Station (E. S. R., 8, 691), showing that in California the cherry is larger, less juicy, and has a little over 1 per cent more flesh, which the author believes may be explained by the fact that California soils are rich in potash, while those of Oregon are phosphatic. The Oregon fruit has slightly more sugar and protein than the California product, equaling the European analyses as regards the former and exceeding them in the latter. The average acid content from the above table is 0.43 per cent and the ratio between the acid and the sugar in the flesh is 1:26.

"It is interesting to note here that Fresenius gives as the ratio for sweet cherries 1 to 11.16 and for sour cherries 1 to 6.85, calculated as malic acid. This would indicate that a considerable improvement has taken place in those grown on the Pacific coast over those examined by him so far as the proportion of sugar is concerned."

It is pointed out that the cherry contains considerable nutritive matter, the proportion of dry matter to water being about 1:4.5. Of the dry matter about two-thirds is sugar. The fruit is recommended for drying.

Variety tests of strawberries, raspberries, and blackberries, W. PADDOCK (*New York State Sta. Bul. 147, pp. 181–198*).—This is a report on the relative time of maturity, productiveness, and hardiness

of varieties fruited on the station grounds in 1898. These comprise 40 varieties of strawberries, 22 of black raspberries, 26 of red raspberries, and 24 of blackberries. Descriptive notes are given on the strawberries. Of these Anlo, a midseason berry, was first in productiveness, with Stahelin, an early fruit, ranking second. Of the late varieties Rural Gem, Oswego Queen, and Michigan are recommended for trial. Of black raspberries Pioneer and Palmer produce the largest amount of early fruit, with Mills ranking first among the late sorts. Among red raspberries Loudon was the most productive. Among blackberries Success and Mereseau are mentioned as promising new sorts.

The European and Japanese chestnuts in the eastern United States, G. H. POWELL (*Delaware Sta. Bul. 42, pp. 35, figs. 12*).—The history of the European and Japanese chestnuts in America is outlined. It is believed that their range will in general coincide with that of the American species. The uses of the nut in France, Italy, Korea, and Japan are stated. Botanically the author prefers to consider the European, American, and Japanese groups as distinct species. Each is described and the synonymy given. Adaptations for cross fertilization are noted, but it is not yet known whether cross fertilization is necessary or not. Mixed planting is recommended as a safeguard. Cultural notes are given. The most serious insect enemy of the chestnut is the weevil (*Balaninus caryatrypes* and *B. rectus*). Methods of combating the pest are suggested. Several fungi attack the chestnut, the most injurious of which are *Marsonia ochroleuca* and *Cryptosporium epiphyllum*. Nine trees in an orchard of Numbos, 20 to 30 ft. high, were sprayed with Bordeaux mixture 4 times during the summer of 1898. The foliage of these trees was free from fungi and bright in color throughout the summer. All unsprayed trees adjoining were slightly affected with the fungi. The labor of applying the mixture is no greater than in spraying apple trees. The body blight of the chestnut is described. It is thought to be in nature not unlike the sunscald of cherry and other young fruit trees. The advantages of the Japanese and European groups are presented in the form of the parallel. A monograph of varieties is appended.

Report of the horticulturist, P. H. ROLFS (*Florida Sta. Rpt. 1898, pp. 36–54*).—Brief notes are given on peaches, asparagus, broccoli, plums, Brussels sprouts, cauliflower, celery, cucumbers, rhubarb, and water cress, together with a table showing the date of sowing, time ready for market and number of days from seeding to gathering of numerous varieties of beans, peas, Brussels sprouts, sweet corn, cabbage, cauliflower, carrots, cucumbers, collard, garden cress, chicory, cherville, endive, English pea, eggplant, kohl-rabi, lettuce, ruta-baga, turnip, tomato, squash, radish, onion, muskmelon, and watermelon.

Simultaneous forcing of carrots and radishes in the same bed, E. LAMBERT (*Rev. Hort., 71 (1899), No. 5, pp. 110, 111*).—A statement of a method which is said to be profitable, together with a list of varieties best adapted for such forcing.

Forcing head lettuce; soils and fertilizers, F. H. HALL and S. A. BEACH (*New York State Sta. Bul. 146, popular ed., pp. 8, pls. 2*).—A popular summary of Bulletin 146 of the station (see p. 957).

Chervil in the sixteenth century, E. ROZE (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), Jan., pp. 75–79*).—Notes on the history and present utilization of this vegetable in France.

Protecting tender trees and shrubs in winter, J. MEEHAN (*Park and Cemetery, 8 (1898), No. 10, p. 191*).—The author states that the winterkilling of many tender evergreens, as *Magnolia grandiflora,* is caused by light and excessive evaporation rather than by low temperatures. Injurious effects resulting from such conditions may be obviated by mulching, covering the foliage, as for instance with leaves, and making screens on the north side of the plant. With deciduous trees and shrubs the screens may be omitted.

Distribution of seeds and plants, E. J. WICKSON (*California Sta. Seed Bul., 1898–99, pp. 14*).—Owing to the serious drought, the distribution of plants and seeds has been seriously interfered with and the number of applications as well as the amount of material distributed have fallen off at least 50 per cent.

Descriptive notes are given of the various plants and seeds which are offered for distribution. Attention is called to the use of resistant apple roots as a stock where the woolly aphis is particularly troublesome. In order to give them a local trial, roots of selected Northern Spy stock have been imported from Australia and will be distributed for use in root grafting.

Means of preventing depredations by rabbits in orchards and nurseries and methods of treating the injured trees, E. S. ZÜRN (*Deut. Landw. Presse, 25 (1898), Nos. 102, pp. 1055, 1056; 103, p. 1065*).

Canning fruit, W. CRAIG, jr. (*Jour. Agr. and Hort., 2 (1899), No. 16, pp. 369, 370*).—Brief historical notes and a statement of principles involved, together with the method that the author considers best.

Some good berries, F. H. HALL and W. PADDOCK (*New York State Sta. Bul. 147, popular ed., pp. 4*).—A popular summary of Bulletin 147 of the station (see p. 961).

The Marcon and Cazenave systems of grape training, P. MOUILLEFERT (*Jour. Agr. Prat., 63 (1899), No. 8, pp. 286–288, figs. 5*).—The former is a modification of the latter; both belong to the French long-pruned cordon system. Neither can be used except with certain varieties on very rich soils.

A method of training the grape in upright cordons by looping, C. GROSDEMANGE (*Rev. Hort., 71 (1899), No. 5, pp. 105, 106, figs. 2*).—A method devised by M. Pécheux. It consists in taking a loop in the cordon and, after pruning, fastening the upper part of it downward at a considerable angle. This method is highly recommended. It is also used on the peach, though with more difficulty.

Green manuring of the vine on the light soils of the center and west of France, G. PAGEOT (*Jour. Agr. Prat., 63 (1899), No. 8, pp. 288–290; 9, pp. 311–314*).—On very poor light soils chemical fertilizers have not given satisfaction. A method is described for the use of green manuring in vineyards on such lands, with an itemized statement of the expense.

The European and Japanese chestnuts in the eastern United States, G. H. POWELL (*Delaware Sta. Bul. 42, abridged ed., pp. 16, figs. 7*).—This is an abridged edition of Bulletin 42 of the station (see p. 962).

Raising new varieties of carnations from seed (*Florists' Exchange, 11 (1899), No. 10, p. 254, figs. 6*).—Practical directions, dealing mostly with the mechanical details of cross pollination.

Synonyms in chrysanthemums, J. F. FAVARD (*Rev. Hort., 71 (1899), No. 3, p. 67*).—A list of synonyms established by the Committee on Classification of the National Chrysanthemum Society of England.

The decline of the orchid (*Garden, 55 (1899), No. 1423, pp. 127, 128*).—A consideration of the causes that have led to a decline, which the author assumes in this article has taken place. While specific application of the argument is made only to the orchid, the discussion would apply with equal force to other flowers that have for a time enjoyed a great measure of popular favor but whose popularity is on the wane.

The history of the Pelargonium, S. HIBBERD (*Jour. Hort., 51 (1899), No. 2630, p. 153; 2631, p. 172*).—A reprint of a lecture delivered before the Royal Horticultural Society in 1880.

FORESTRY.

Progress and effects of forest growing, R. W. FURNAS (*Forester, 4 (1898), No. 12, pp. 243–248*).—The object of this somewhat popular paper is to show briefly what has been done and what may be done in converting the naturally timberless portions of the country into tree-growing regions. It is based upon the author's personal experience during a residence of 43 years in what is now the State of Nebraska. The early attempts at forest planting are described and the effect of tree-planting legislation shown. The author states that from 1854 to 1896, 298,479 acres of land have been planted to forest trees in the State of Nebraska. This includes seedlings, seeds, and cuttings planted in permanent forests, groves, and along highways and streets. Spontaneous indigenous growth is estimated to equal half as much as the area planted. The different methods of planting are discussed; and placing the estimate at the average distance of planting the author states that the area planted, together with the spontaneous increase would give a grand total of 1,065,689,757 trees for the 43 years. To this should be added 15,838,250 fruit trees which have been planted within the State.

The different kinds of forest trees which can be successfully and satisfactorily grown, both when planted and spontaneously growing, are enumerated. The following actual measurements of tree growths of known ages were made by the author and the Hon. J. Sterling Morton a few years since, showing the circumference in inches 2 ft. above ground:

Size of forest trees of known ages grown in Nebraska.

	Age.	Circumference.		Age.	Circumference.
	Years.	*Inches.*		*Years.*	*Inches.*
White elm	15	$24\frac{3}{4}$	Black walnut	22	48
Do	24	63	Do	16	18
Red elm	24	36	Do	16	$15\frac{1}{4}$
Catalpa	20	$48\frac{1}{2}$	White walnut	16	$49\frac{1}{4}$
Soft maple	18	$54\frac{3}{4}$	Osage orange	25	$26\frac{1}{4}$
Do	18	$69\frac{1}{4}$	Larch	10	24
Sycamore	16	$43\frac{1}{2}$	White pine	20	$36\frac{1}{4}$
Pig hickory	24	$27\frac{1}{2}$	Do	12	29
Shag-bark hickory	24	30	Scotch pine	15	23
Cottonwood	23	$78\frac{1}{4}$	Do	10	36
Do	11	93	Austrian pine	11	$22\frac{1}{2}$
Do	25	98	Balsam fir	12	26
Chestnut	14	$24\frac{1}{2}$	Red cedar	12	$26\frac{1}{4}$
Box elder	14	$25\frac{1}{4}$	White cedar	12	22
Do	14	$31\frac{1}{8}$	Mulberry	18	43
Honey locust	22	$40\frac{1}{4}$	Do	18	$39\frac{1}{4}$
Do	22	$41\frac{1}{4}$	Russian mulberry	6	24
Kentucky coffee tree	14	$25\frac{1}{2}$	Linden	14	35
Bur oak	22	$36\frac{1}{8}$	Poplar	4	12
Do	26	$43\frac{1}{2}$	Silver-leaf poplar	12	67
White oak	22	29	Black locust	24	$60\frac{1}{2}$
Red oak	22	$37\frac{1}{8}$	Red willow	20	58
Black oak	22	$38\frac{1}{2}$	Gray willow	15	$26\frac{1}{4}$
White ash	22	$32\frac{1}{4}$	Yellow willow	21	132
Green ash	22	30			

The relative value of different kinds of trees is discussed, the cost of planting, distances, and some of the insect enemies of forest trees are mentioned.

Preserving timber for estate and other purposes, D. F. MACKENZIE (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 1–26, figs. 13*).—The author describes various kinds of timber and gives in some detail methods for preserving the same. The ingredients chiefly used are vegetable oils and tar mixed together, creosote, copper sulphate, iron sulphate, zinc chlorid, sodium chlorid, mercury bichlorid, calcium chlorid, and other ingredients such as carbolic acid, arsenical acids, lead acetate, and barium sulphurate. The methods described are immersion in a solution of chlorid of zinc, immersion in corrosive sublimate, a solution of copper sulphate applied under pressure, a solution of iron sulphate combined with a solution of barium or calcium injected into the wood; the creosote process and a process called thermo-carbolization. This last process consists of the treatment of wood with carburated steam in order to extract the natural sap and free water and at the same time charge the vessels or pores with a preserving agent. The cost of the different methods is given and the special advantages of each discussed.

Cultivated shade and forest trees, B. C. BUFFUM (*Wyoming Sta. Bul. 38, pp. 34, pls. 12*).—The general forestry conditions of the State are briefly stated and the danger of extinction of native forests, the necessity for their preservation, and the influence of the trees on the growth of plants are pointed out. Suggestions are given for the planting and care of trees, and some experiments which have been carried on by the station are reviewed. It appears that at high elevations sudden frosts in the fall arrest the growth of many trees before they have ripened their wood. On this account some of the slow growing varieties, such as hardwood trees, fail to increase in size above the ground because each season's growth dies back to the original stem or to the top of the ground in the fall or winter. This has occurred year after year with ash, elm, and honey locust and sometimes with the willows where no protection was given them.

Detailed notes are given of the relative value of a number of trees for forest as well as ornamental planting in Wyoming. Arranged in the order of their hardiness, the list of trees which have been tested in the State is as follows: Cottonwood, willow, silver spruce, Douglas spruce, box elder, hardy apples, dwarf cherry, silver maple, cedar, white ash, green ash, locust, elm, Morello cherries, plums, mountain ash, soft maple, black walnut, butternut, birch, mulberry, catalpa.

A number of insect enemies which are liable to be met with are mentioned and remedies suggested for their destruction.

The home nursery in forestry, A. C. FORBES (*Gard. Chron., 3. ser., 25 (1899), No. 638, pp. 163, 164*).—The advantages of a home nursery are pointed out and suggestions given for its management.

Concerning the American red cedar (*Oesterr. Forst. u. Jagdw. Ztg., 17 (1899), No. 8, p. 60*).—Notes are given on *Juniperus virginiana*.

The reforesting of white pine lands (*Forester, 5 (1899), No. 3, pp. 61, 62*).—Quotations are given from the Forest Warden of Minnesota on the present condition of the pine forests of the State and notes on the possible income from reforested lands.

Measuring the forest crop, A. K. MLODZIANSKY (*U. S. Dept. Agr., Division of Forestry Bul. 20, pp. 71, figs 15*).—This bulletin is a brief presentation of the methods by which measurements of felled and standing trees, as well as of whole forests, may be performed, together with a discussion of a method developed by the author for ascertaining the rate of growth of trees and forest crops. This method, it is said, has been tested, and the results obtained recommend it for the rapidity with which a large number of measurements may be coordinated and summarized.

Periodicity in the growth in thickness of trees, J. WIELER (*Tharand. Forst. Jahrb., 48 (1898), p. 100; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, p. 52*).—It is stated that often in closely contiguous spots the growth and thickness of tree trunks is far from uniform. There are in general, both with conifers and dicotyledons, 2 periods of greatest activity, the one about the beginning of June and the other about the middle of July. The latter period of activity is subject to great variations. The period of greatest activity in the development and unfolding of buds does not necessarily agree with the greatest activity of the cambium.

SEEDS—WEEDS.

Experiments on red clover seed, A. N. MCALPINE (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 224–234*).—The author conducted a series of experiments to ascertain whether there was any connection between the yield of clover and the general appearance, size, weight, name, nationality, and price of seed.

Seven lots of seed were purchased in the open market and their purity and germination determined, after which they were distributed to various growers and grown under numbers, no indications being given the grower as to the origin of the seed. The principal experiment in growing was made at Carbeth, where it was continued for 4 years. In the accompanying table the price per pound, purity, germination, number of seed per pound, yield of hay per plat for 4 years, and order of productiveness is given:

Comparative tests of red clover seed.

	Price per pound.	Purity of seed.	Germination of seed.	Number seed per pound.	Yield of hay per plat, 4 years.	Order of productiveness.
	Cents.	*Per cent.*	*Per cent.*		*Cwt.*	
American	12	98	84	297, 300	70 3	3
Canadian	14	100	92	287, 400	67 5	4
French	15	99	87	272, 600	58. 6	6
American (*Trifolium medium*)	15	100	91	260, 000	75. 9	2
New Zealand	19. 5	100	92	212. 500	76. 1	1
English	24	98	94	216, 300	64. 7	5
German	15	99	89	206, 900	42. 8	7

Other experiments conducted at different places showed either very slight or no appreciable difference. In one case the yield of the plat seeded with American red clover exceeded that of any of the others. In hardiness, as shown by the last cutting at Carbeth, *Trifolium medium*

ranked first, American red second, Canadian third, the others greatly inferior, and the French nothing.

The general conclusion is drawn that the product depends on the germinating power of the seed used and the number of pure and germinating seed per pound. If these conditions are satisfied the size and appearance of seed will be of little account. As a satisfactory basis for valuation of seed the author states that the purchaser should take into account the percentage of purity, percentage of germination, and number of seeds per pound. The highest priced seed in his experience did not yield the largest crop.

Studies in germination, V. JODIN (*Ann. Agron., 24 (1898), No. 8, pp. 382–397*).—The author continues to report his investigations on the germination of seed, the present paper treating of the differences between very old and fresh seed in their intramolecular respiration and on the potentiality of seed. Intramolecular respiration was found to diminish as the age of seed increased. Peas 33 years old failed to give off carbon dioxid when in suitable media for germination. A very small quantity was given off from 27-year-old peas and increasing amounts from still newer seed.

Influence of the weight of seed on the yield of cereals, L. GRANDEAU (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 47*).

Tobacco seed: its choice; light and heavy seed, TRABUT (*Gour. Algerie Bot. Service Bul., 1898, No. 17, pp. 8, illus.*).

On the specific gravity of rice seeds at different stages of ripening, H. ANDO (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 479–481*).—The specific gravity of rice seed was tested at various periods of growth, namely, milk-ripe, green-ripe, yellow-ripe, full-ripe, and dead-ripe. From the tables given it is clearly shown that the specific gravity increases with ripening.

DISEASES OF PLANTS.

On the use of sulphur and sulphate of ammonia as preventives of potato scab in contaminated soils, H. J. WHEELER and G. E. ADAMS (*Rhode Island Sta. Rpt. 1897, pp. 254–268*).—The trials with sulphur which were conducted in 1896 (E. S. R., 8, p. 798) indicated that when thoroughly mixed at the rate of 600 lbs. per acre in the upper 7 or 8 in. of a badly contaminated soil, though checking the diseases somewhat, was practically useless. In 1897 2 series of experiments were made to continue the study.

In the first series seed tubers of the variety New Queen, which were practically free from scab, were planted in pots 26 in. deep and 18 in. in diameter, which were buried in the ground to within 2 in. of their tops. Each pot received as fertilizer air-slaked lime, dried blood, nitrate of soda, muriate of potash, dissolved boneblack, and tankage. In previous years the pots had received barnyard manure alone or with common salt, sodium carbonate, or oxalic acid. Sulphur and corrosive sublimate were compared as fungicides. Part of the tubers were treated with 1:1,000 corrosive sublimate solution for 1½ hours; others

were moistened and rolled in sulphur at the rate of 300 lbs. per acre, the sulphur not adhering to the tubers being dusted over them before covering by the soil; and other tubers received no treatment. The results obtained showed that the sulphur treatment was slightly more efficient than corrosive sublimate, and also that the disease germs were present in great quantities in the soil, as otherwise the corrosive sublimate treatment would have reduced the amount of scab as compared with no treatment.

In the second series of experiments the same pots and soil were used as in previous experiments, which had been treated with lime, wood ashes, calcium chlorid, sulphate, carbonate, oxalate, or acetate. The seed tubers were washed before attempting to examine them for scab. All the tubers were treated with 1:1,000 corrosive sublimate solution for 1½ hours before planting. In addition, a part of the tubers were treated with sulphur in the same manner as in the first experiments. The efficiency of the acid soil and calcium sulphate and chlorid in preventing the development of scab was shown, not a trace of scab being found where either of the calcium compounds were applied. The poisonous action of these substances on the crop was quite markedly indicated, as in previous years' experiments. Comparing the sulphur and corrosive sublimate treatment for the prevention of scab, it was found that there was a reduction of about 21 per cent in the number of badly scabbed tubers where sulphur was used.

In consideration of the cost of sulphur when applied in large quantities, and owing to the fact that it has little or no manurial action, the results are compared with the favorable results previously obtained with sulphate of ammonia, and further experiments in this line are promised.

The authors summarize their results as follows:

"The results of 1897 fully confirm those of previous years as to the tendency of carbonate of lime, and all combinations of lime which are changed into that form within the soil, to promote in a striking degree the development of the potato scab.

"On a badly contaminated soil the use of sulphur for 2 consecutive years, in quantities amounting in all to 900 lbs. per acre, reduced the amount of scab in a decided degree.

"Owing to the cost of sulphur, and the improbability of its being of more than slight, if any, indirect manurial value, it appears possible that the employment of sulphate of ammonia, which is at the same time a valuable source of nitrogen, might prove more economical than sulphur in reducing the tendency to scab on soils already contaminated with the scab fungus. The results thus far secured indicate that if it were employed in connection with kainit, sulphate, or muriate of potash, soils would be rapidly improved in this particular.

"Owing to the fact that soils naturally favorable to the development of the potato scab are also favorable to nitrification, the fullest manurial action of the sulphate of ammonia should be obtained."

The asparagus rust, L. F. KINNEY (*Rhode Island Sta. Rpt. 1897, pp. 317–321*).—During the summer of 1897 the asparagus rust (*Puccinia asparagi*) made its appearance in various Rhode Island market gardens.

Prior to this time the disease had not been reported by asparagus growers in the State, but a thorough investigation showed it rather generally spread. The effect of the disease upon the plants is shown in their exhausted vitality. The mowing and burning of the stalks was thought a possible means for the prevention of the spread of this disease, but its wide distribution showed that nothing would be gained by such treatment. All efforts to control asparagus rust have been only partially successful. The difference in the amount of rust found on different varieties, the author thinks, may not be wholly due to varietal peculiarities, but from the limited data accessible there appear to be differences in resistance. Shallow plowing of the beds after the stalks have been cut has been tried, and it is thought possible in this way that the spores of the fungus which are lying on the surface may be covered and destroyed. The aggregate value of asparagus beds in the 2 centers referred to in this report is said to be $200,000, and should this disease continue its course for a few years the greater part of the capital would be lost.

Studies on Puccinia ribis of red currants, J. ERIKSSON (*Rev. Gén. Bot., 10 (1898), No. 120, pp. 497–506, pl. 1*).—As a result of his experiments the author concludes that *Puccinia ribis* is a true micropuccinia with only 1 generation of spores. These are teleutospores, which germinate the spring after their formation. In the fungus it is possible to distinguish a special form to which the author gives the name *rubi*, which attacks the red currant and also a variety of the white, but not the black currant, nor in all probability does it attack the gooseberry. The appearance of the disease occurs in the spring after hibernation of the spores, and the period required for their germination is from 29 to 39 days. As preventive measures against the destructive effect of this fungus, the author recommends the collecting together and burning in the fall of the year all leaves and diseased fruits which fall from the bushes. In the spring all bushes which are liable to attacks of this fungus should be thoroughly sprayed about the time their buds begin to swell, 2 applications of Bordeaux mixture being given during the season. Not only should the bushes be sprayed, but the ground underneath them.

Contribution to the knowledge of Coleosporiums and the leaf rust of pines, G. WAGNER (*Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 257–262*).—The author reviews a number of experiments and statements on the relation existing between the alternate host plants of a number of species of Peridermium and Coleosporium. He briefly reviews his own experiments in which a number of plants were inoculated with the æcidiospores from *Pinus sylvestris* and *P. montana*. It was found that in nearly every case the æcidiospores would infect *Melampyrum pratense* and *Euphrasia officinalis*, but not *Campanula rotundifolia*, *C. trachelium*, *Phyteuma officinalis*, and *Tussilago farfara*.

In a subsequent note in the same journal (No. 6, p. 345) the author

claims to have infected pine needles with spores from *Coleosporium campanulæ micrantha*, the spermagonia appearing in October.

Inoculations of pine needles made in September with spores of *C. sonchi-arvensis* from *Sonchus asper*, and *C. tussilaginis* from *Tussilago farfara* resulted in the appearance of spermagonia in November.

The leaf-spot disease of walnuts H. BOLTSHAUSER (*Ztschr. Pflanzenkrank., 8, (1898), No. 5, p. 263*).—The author reports the appearance in Thurgau during July of the past year of a disease of walnut leaves. The spots were very numerous, round, and dry, the inner portion brownish gray, and the outer part darker, more or less arranged in zones. The spots were of various sizes, ranging from 1 mm. to 1 cm. in diameter and occurred on both sides of the leaves. The dried leaf substance finally falls from the leaves. The perithecia which are found on the upper side of the leaf are globular, more or less sunken, about 0.08 mm. in diameter. The spores are oblong, 2-celled, and often constricted in the middle. They are from 0.01 to 0.013 mm. in length and from 0.004 to 0.005 mm. in diameter. The fungus, which appears to have been undescribed, has been given the name *Ascochyta juglandis*.

Notes on the Michigan disease known as "little peach," E. F. SMITH (*Reprint from Fennville Herald, 1898, Oct. 15, pp. 12*).—In an address before the Saugatuck and Ganges Pomological Society the author describes this little-known disease which threatens to become of great importance to the peach growers of that State. The symptoms of the disease are the dwarfing of the fruit, retarded ripening of fruit, absence of any red spotting of skin or flesh, the dwarfing or yellowing of the foliage from the start, and the absence of sprouting winter buds. The affected peaches are badly dwarfed, usually one-half or less the size of ripe healthy peaches of the same variety. The color of the skin and flesh is normal. The pits are small but hard and well developed. The leaves are much smaller than normal, perhaps on an average only about half as large. They are thicker, of a sickly, yellowish, reddish, or brownish green color. The diseased leaves examined were found free from mildew, fungus, or insect depredations. Unlike the rosette and yellows of the peach this disease often appears on all parts of the tree, although sometimes it appears first on one or more limbs, spreading to the remainder of the tree. The main root and all other larger branches appear sound in bark and wood, but the ultimate rootlets were found badly diseased in every specimen examined, fully nine-tenths of the rootlets being found dead and shriveled or brown and dying. Trees attacked by this disease are said to die the second or third year. This disease has been attributed to various causes, several of which are discussed. The author states that in his opinion the disease is due to shutting off of the water supply to the tree, but whether this is brought about by some parasite or by drought combined with overbearing and unsatisfactory condition of soil can not as yet be determined.

Report of the biologist, P. H. ROLFS (*Florida Sta. Rpt. 1898, pp. 27-36*).—The work in botany for the year is briefly reviewed and notes given on a number of important plant diseases. The fungus tomato blight is briefly discussed, a more extended description and discussion having been given in Bulletin 21 of the station (E. S. R., 5, p. 790). The bacterial tomato blight and tomato rust are also described. Notes are given on the fungus disease of the San José scale, a detailed account having been previously published in Bulletin 41 of the station (E. S. R., 9, 1068). Celery blight, due to *Cercospora apii*, and the pear blight or twig blight are described, and preventive measures suggested.

Diseases of cultivated plants in Cyprus, P. G. GENNADIUS (*Rpt. Agr. Cyprus, III, p. 51; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 281-283*).—Notes are given on diseases of grapes, citrus fruits, olives, apple trees, and cereals. A brief report is given on the destruction of Orobanche and Euphorbias. The first plant, it is said, may be destroyed by applications of potash and phosphate fertilizers, also 5 per cent solutions of copper sulphate will destroy Orobanche seeds. The Euphorbias, it is said, may be destroyed with carbon bisulphid, or with petroleum mixed in fertilizers.

Diseases of sugar cane in the Antilles, G. SAUSSINE (*Bul. Agr. Martinique, 1898, No. 2, pp. 41-53*).—Notes are given on *Alectra brasiliensis*, a saprophytic phanerogam, 2 cryptogams (*Trichosphæra sacchari* and *Colletotrichum falcatum*), and several diseases of unknown origin.

Fungus diseases of the grapevine, ALLEN, BLUNNO, FROGGATT, and GUTHRIE (*Agr. Gaz. New South Wales, 10 (1899), No. 1, pp. 26-31*).—Notes are given on a number of diseases of the grape, with suggestions for their prevention.

Black rot of grapes and its treatment, G. D'UTRA (*Bol. Inst. Agron. São Paulo, 9 (1898), No. 6, pp. 268-271*).

The treatment of pourridie L. ROUGIER (*Prog. Agr. et Vit. (ed L'est), 20 (1899), No. 11, pp. 327-333*).—Carbon bisulphid is said to be the most efficient means for preventing the destruction of grapevines by *Dematophora necatrix*.

On the use of carbon bisulphid against Dematophora necatrix, J. DUFOUR (*Chron. Agr. Cant. Vaud, 12 (1899), No. 4, pp. 87-90*).—Notes the very successful use of this fungicide against this pest.

Monilia variabilis, P. LINDNER (*Wchnschr. Brau., 15 (1898), No. 16; abs. in Bot. Centbl., 77 (1899), No. 2, pp. 67, 68*).—A variable new species is described which was found growing upon white bread that had been moistened with beer yeast.

The chrysanthemum rust, L. WITTMARCK (*Gartenflora, 47 (1898), No. 23, pp. 625, 626, fig. 1*).—Notes are given on *Puccinia hierocii*.

Tea blights, G. A. MASSEE (*Kew Misc. Bul. 138, pp. 105-122, pl. 1*).—The author describes the attack on tea of *Pestalozzia guepini*, *Exobasidium vexans*, and *Stilbum nanum*. The first species is also parasitic on rhododendron, citrus, magnolia, etc.

Mildew of hops, L. MANGIN (*Jour. Agr. Prat., 1899, I, No. 10, pp. 345-347, fig. 1*).—Notes are given on *Sphærotheca castagnei*.

A pestalozzia disease of lupines, F. WAGNER and P. SORAUER (*Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 266-271, pl. 1*).—The authors describe a very destructive disease of lupines, which is said to be caused by *Pestalozzia lupinii*, n. sp. Different species of lupines seem to vary in degree of susceptibility to the disease, *Lupinus cruikshanksii* and *L. mutabilis* being quite susceptible, while *L. albus* and *L. luteus* are less so. In cultivating these plants to avoid the disease care should be taken in the selection of varieties, and the soil should not be allowed to become too wet.

The mycocecidia of Rœstelia, L. GENEAU DE LAMARLIÈRE (*Rev. Gén. Bot., 10 (1898), No. 114, pp. 225-237; 115, pp. 273-288, pls. 2, figs. 5*).

An undescribed disease of peonies and lily of the valley, J. RITZEMA-BOS (*Ztschr. Pflanzenkrank., 8 (1898), No. 5, pp. 263-266*).—The author describes diseases of the peony and lily of the valley which are said to be caused by *Botrytis pæoniæ*. On both plants it has proved quite destructive. Experiments were made on Convallaria

leaves which were sprayed with Bordeaux mixture. In one case the leaves were severely injured by the treatment, while in the other case there was little evidence of checking the spread of the disease.

A bacterial disease of Juniperus phœnicea, F. CAVARA (*Bul. Soc. Bot. Ital., 1898*).

Wet rot in potato, C. WEHMER (*Ber. Deut. Bot. Gesell., 16 (1898), pp. 172-177, figs. 2; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, p. 69*).—The opinion is expressed that the wet rot of the potato is not primarily a bacterial disease, but is due to certain conditions of environment. The author's experiments show that potatoes placed in moist positions, although exposed to aerial and contact infection, remain free from wet rot if they are left uncovered; on the other hand, if covered, the tubers will in a few days be affected with wet rot. When the environmental conditions are suitable, the bacteria are active, and though it is possible that many may be able to produce decomposition, there are 2 species most frequently met with, namely, *Bacillus* sp. and *Amylobacter navicula*.

Recent observations on Pseudocommis, E. ROZE (*Bul. Soc. Mycol. France, 15 (1899), No. 1, pp. 37-43*).—Experiments with this myxomycete on beans are briefly reported.

Underground galls of beets and crucifers and their causes, VON DOBENECK (*Pract. Bl. Pflanzenschutz, 1 (1898), pp. 61, 62*).

Nematodes and means for combating them, C. SCHREIBER (*Agronome, 1898, Nos. 47, 48*).

ENTOMOLOGY.

Some injurious insects, A. L. QUAINTANCE (*Florida Sta. Rpt. 1898, pp. 56-72, pls. 4*).—Notes are given on a number of insects which have proved more or less destructive to certain economic plants. The sweet potato prodenia (*Prodenia commelinæ*), which has heretofore been considered of little economic importance is described. During the fall of 1896 and the summer of 1898, the larvæ caused considerable destruction by feeding on tomato and Irish potato leaves. In a number of places the insect has been observed feeding on sweet potato leaves and has caused considerable damage to the crop throughout the regions infested. After the foliage has been eaten the larvæ have been observed to migrate and attack various plants, such as crab grass, wild coffee plant, partridge pea, tomato, okra, and tobacco. But little data are given as to the life history of the insect. For its prevention the use of Paris green at the rate of 1 oz. to 10 gal. of water, to which 1 oz. of quicklime previously mixed should be added, is recommended.

A number of scale insects are described, among them the snowy chionaspis (*Chionaspis minor*), which has been abundant on the China tree (*Melia azederach*). It has also been reported as feeding on palms, cotton, capsicum, hibiscus, and grapevines. The appearance of the scale is briefly described, and it is stated that thorough winter spraying with strong whale-oil soap or a kerosene-and-water mixture might prove efficient in destroying this pest.

The fig scale (*Asterolecanium pustulans*) is known in the east coast region of Florida, where it occurs on the fig, mulberry, and oleander. The scale is somewhat circular in outline, slightly convex, and of a yellowish color. Under a hand lens the scale is seen to be surrounded

by a delicate fringe of pink color. No experiments are known with insecticides, and it is thought advisable to destroy infested plants by digging them up and burning them.

The cassava scale (*Mytilaspis alba*) made its appearance in Florida in March, 1898, on cassava canes which had been imported from Nassau. A considerable quantity of the infested canes were destroyed, and the author visited the fields in which the remaining canes had been planted, but after a careful investigation was unable to find any trace of insects. While it is believed that this threatened pest has been exterminated, the immediate burning of cassava or other plants upon which it is discovered is recommended.

The rust-red flour beetle (*Tribolium ferrugineum*) has proved a serious household and museum pest in Florida. Flour, corn meal, and similar products become badly infested if left exposed. In museums the pest is particularly severe, especially on dried insects. Its methods of attack and injury are described and brief notes given on the life history, from which it appears that the life cycle is completed in about 30 days. The egg state continues for 12 days, the larval 14 days, the pupa state about 5 days. The life of an adult in captivity is from 25 to 30 days. The different stages in the life history of this insect are described. Where it is possible the use of carbon bisulphid is recommended as a treatment.

Notes are given of the chinch bug, which has occurred in various places in Florida, but on account of the amount of wet weather which occurs in the State, it is thought probable that it will never prove seriously destructive in the State.

The rubus white fly (*Aleurodes ruborum*) was first noticed in November, 1898, infesting several of the varieties of *Rubus trivialis*. The presence of these scales in such great numbers would necessarily be a serious drain upon the plant, but the insects have been closely observed since their discovery and there seems to be no occasion for regarding it as of very great economic importance. This scale is probably a native of Florida and has been taken in several widely separated localities on both *Rubus trivialis* and *R. cuneifolius*. A number of hymenopterous parasites have been bred from the pupæ, and it is stated that about 65 per cent of the pupæ are destroyed by parasites.

The ramie-leaf roller (*Pyrausta theseusalis*) has been abundant on the leaves of ramie grown at the station for the past 2 years. Fully 50 per cent of the leaves were rolled up from one side forming a hollow tube ½ inch in diameter. Within these tubes the larvæ feed, eating along the rolled up and covered margin, or sometimes eating the distal end of the tube. These insects have not been observed earlier than July and seem to be most abundant about the middle of September. Specimens of young larvæ placed in breeding cages grew to adult larvæ in about 20 days, pupated within the rolled up leaves, and developed into adults in 23 days. Attempts to secure eggs from moths bred in confinement were fruitless, but making due allowance for the

egg state, the life cycle is probably not shorter than 50 days. A description is given of the different stages of the insect, and as a preventive treatment the author states that probably the best means would be to pick off and burn the rolled up leaves as soon as observed. The use of Paris green or some other arsenite might be of value, but from the feeding habit of the insect many would doubtless escape poisoning.

The report concludes with descriptions and notes on *Pyrameis cardui*, the larvæ of which has been observed for the past 2 years feeding upon prickly comfrey grown in the station grounds.

A serious attack on the apple fruit by Argyresthia conjugella in Europe, E. REUTER (*Canad. Ent., 31 (1899), No. 1, pp. 12–14*).—The presence of this new apple pest in British Columbia has been mentioned in the report of the Canadian Experimental Farms for 1896 (E. S. R., 10, p. 856), in which it is stated that the injuries done closely resemble those caused by the apple maggot (*Trypeta pomonella*). The caterpillars tunnel the pulp of the fruit, leaving brown colored channels, with rather large chambers here and there; this attack thus being easily distinguishable from that of the common codling worm.

According to the author, during the summer of 1898, there was an unexpected and violent attack of this insect on the apple in Finland. In Finland this insect ordinarily feeds on the fruit of the mountain ash and sometimes on that of the bird cherry, but in the summer of 1898 the fruit of both of these failed almost entirely and the insect, not finding its ordinary food, swarmed in immense numbers to the apple trees.

On the relations of a species of ant (Lasius americanus) to the peach-root louse, F. M. WEBSTER (*Canad. Ent., 31 (1899), No. 1, pp. 15, 16*).—The author has had occasion to study the root louse on the roots of young peach trees and has been impressed with the attention given them by ants. Attention has previously been called to the relation existing between ants and peach-root louse by E. F. Smith,[1] who stated as probable that the ants bring the plant lice from below ground in the spring and place them upon the twigs, thus indirectly causing their diffusion in the orchards.

In the investigations reported the author states that he has not only been able to observe the attention of the ant in caring for the aphis on the roots, but has also found them transporting them about on the twigs, and he has no doubt that they are also transported from twig to root and *vice versa*. Below ground the aphis is said to usually cluster upon the tender roots or rootlets with ants in constant attendance. Where there was a lack of rootlets the bases of some of the roots and also the crown had patches of bark removed, and the wounds had every appearance of having been caused by gnawing away the bark. On further examination it was found that where these wounds had begun to heal over, the wounds were closely packed with the root lice attended by ants. It appears that the aphis can subsist on this tender growth

[1] Entomologica Americana 6, p. 101.

of over-healing bark as well as though they were colonized on the tender rootlets. Where the wounds on the peach roots were infested by the aphis all bits of gum and detached bark had seemingly been removed, thus giving a clear area for the work of the aphis; and here as elsewhere the ants were found carefully looking after them. The conclusion reached is that the ants intentionally gnaw the bark on the roots where there is a lack of rootlets for the required feeding in order to furnish a supply of food for the aphis.

Second report on the San José scale, H. P. GOULD (*New York Cornell Sta. Bul. 155, pp. 159–171, figs. 3*).—The observations recorded in this bulletin are in continuation of those previously given (E. S. R., 10, p. 468). The author is inclined to believe that by the use of mechanical mixtures of kerosene and water it is possible to kill the scale and not injure the foliage of the plants. His experiments reported in the previous bulletin were repeated during 1898, and a large number of small pear trees badly infested with the San José scale were treated with solutions and mixtures of whale-oil soap, pure kerosene and kerosene diluted with various amounts of water, quassaine, and West's insecticide. The effects of these different insecticides upon the foliage of the trees is given and their efficiency as insecticides compared. The best results were obtained with the kerosene.

The author states that the practicability of spraying for the destruction of the San José scale will depend largely upon conditions. In the case of fruit trees or ornamentals permanently set which have not become weakened by attacks of the insect it will be entirely feasible to protect the trees from further injury by spraying them with kerosene, but spraying can not be recommended for nursery stock. For the latter fumigation with potassium cyanid is recommended. The most satisfactory time for spraying is during the active stage of the scale in the summer and early fall.

The effect of kerosene on peach and apple trees was investigated to some extent. It is stated that pure kerosene will seriously injure peach trees even when they are in a perfectly dormant condition. A 20 per cent mixture can probably be safely used on the peach at any time, but stronger mixtures are to be avoided. Apple trees do not appear as susceptible to injury by kerosene as peach trees, and upon apple trees a mixture containing 50 per cent or less may be used with safety. Kerosene is especially likely to cause injury if applied on other than a bright sunny day. In the author's experiments a 20 per cent solution was found harmless to plants and destructive to all insects.

Diseases of sugar cane in the Antilles, G. SAUSSINE (*Bul. Agr. Martinique, 1898, No. 1, pp. 23–35*).—Notes are given on the following insects: *Diatræa saccharalis*, *Xyleborus perforans*, *Sphenophorus sacchari*, scale insects, plant lice, etc.

Contributions to the knowledge of Coccidæ, T. D. A. COCKERELL and P. J. PARROTT (*Industrialist, 25 (1899), No. 4, pp. 227–337*).

A new enemy of wheat, F. NOACK (*Bol. Inst. Agron. São Paulo, 9 (1898), No. 6, pp. 261, 262*).—The larvæ of *Æolus pyroblaptus* are said to be very injurious to wheat.

The flying mechanism of insects, C. JANET (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 4, pp. 249–253*).

On the head formation of Hymenoptera at the time of their passing into the nymphal stage, L. G. SEURAT (*Compt. Rend. Acad. Sci. Paris, 128, 1899, No. 1, pp. 55, 56*).

FOODS—ANIMAL PRODUCTION.

On the cleavage products of casein in pancreatic digestion, U. BIFFI (*Arch. Path. Anat. u. Physiol. [Virchow], 152 (1898), No. 1, pp. 130–157*).—A number of experiments are reported. The principal conclusions follow: Under favorable conditions casein is completely digested. About 4 per cent of the total amount of casein is converted into tyrosin. The final cleavage product of casein (casein antipeptone) has the following percentage composition: C 49.7, H 7.2, N 16.3 (S 1.3), O 25.2. In properties and reaction it is like fibrin-antipeptone. The casein albumoses may be divided into 2 groups, primary and secondary, and agree in their reaction with those from fibrin. Casein-phosphorus occurs in the products of digestion in 2 forms, one may be precipitated with magnesium mixture and the other not. The phosphoric acid compound increases with the length of the period of digestion and the amount of ferment present, while the other phosphorus compound is diminished. Further, the organic phosphorus can be converted into the inorganic compound by the action of dilute alkali solutions and by boiling with barium carbonate in the same way as the phosphorus compounds derived from casein by digestion with pepsin and hydrochloric acid.

Dietary studies in Chicago, reported by W. O. ATWATER and A. P. BRYANT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 55, pp. 76*).—A number of investigations were conducted among families of foreign birth or origin in the thickly congested West Side of Chicago. A number of samples of food were analyzed in connection with the study. In general the usual methods were followed. In some cases the statistics were prepared by the families themselves and the results thus obtained are regarded as not entirely reliable. The average results follow:

Average results of dietary studies—cost and amounts of nutrients eaten per man per day

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Italians, average of 4	15.8	103	111	391	3,060
French Canadians, average of 5	22.1	118	158	345	3,365
Orthodox Russian Jews, average of 10 *a*	18.4	121	87	410	2,985
Orthodox Russian Jews, average of 4 *b*	19.0	120	101	406	3,095
Unorthodox Russian Jews, average of 6 *a*	22.0	153	105	430	3,365
Bohemians, average of 8 *b*	11.5	115	103	360	2,885
Bohemians, average of 25 *a*	19.7	143	135	424	3,580
American professional men, average of 3	29.1	104	121	429	3,310

a This average includes both those studies in which the statistics were kept by the families themselves and those in which the statistics were kept by those in charge of the investigations. The figures are not to be considered as entirely reliable.

b This average includes only the studies in which the foods were weighed by those conducting the studies.

The results are discussed in detail and compared with the results of similar investigations in New York and Pittsburg (E. S. R., 9, pp. 1074, 1075).

Foods rich in protein. The advantage of a guaranteed composition, E. B. VOORHEES (*New Jersey Stas. Bul. 131, pp. 14*).—The composition and adulteration of feeding stuffs is discussed. To determine whether the cotton-seed meal sold in the State was adulterated, 17 samples obtained from 11 different counties were examined. Of these 2 samples were undecorticated products. Samples of linseed meal, gluten meals, and other gluten feeds were also analyzed. The maximum, minimum, and average percentage of protein and fat in the samples is reported, and the results of similar work in Maine and Massachusetts are quoted. The advantage of a guaranteed composition of feeding stuffs is pointed out. The cost of protein in the feeding stuffs is discussed:

"A comparison of the composition of these feeds with their average selling prices during the past year shows that the gluten meals, at an average cost per ton of \$18.75, furnish the protein at a less cost than any of the others, while cotton-seed meal, at an average cost of \$24 per ton, is next in order, with gluten feeds with an average cost of \$15.70 third in order, and linseed meal fourth at an average cost per ton of \$28.85. That is, from the standpoint of cheapness of protein alone this is the order that they would take. Other points, however, should be considered, as, namely, their general adaptability and their content of mineral constituents, if these are taken into account as they should be in well-managed dairies, the order of cheapness would be cotton-seed meal first, linseed meal second, gluten meal third, and gluten feed fourth."

The chemical life history of lucern, II, J. A. WIDTSOE and J. STEWART (*Utah Sta. Bul. 58, pp. 90*).—This bulletin, which forms part of an extended study of alfalfa (E. S. R., 9, p. 164), treats of the action of various solvents upon alfalfa, the carbohydrates and nitrogenous constituents of alfalfa, and the digestibility of alfalfa cut at different periods of growth. Other features of the chemical composition of alfalfa are discussed, as well as the proper time to cut this crop for hay.

The action of various solvents on alfalfa (pp. 8–26).—A detailed study was made of the material obtained by the successive action of ether, alcohol, water, dilute hydrochloric acid and sodium hydrate solution upon alfalfa. From 2 to 3 gm. each of different parts of 3 successive crops of alfalfa was extracted with anhydrous ether, with the following results:

Ether extract and dry matter in alfalfa.

	Ether extract in—			Highest yield of dry matter per acre.
	Whole plant.	Leaves.	Stalks.	
	Per cent.	*Per cent.*	*Per cent.*	*Pounds.*
First crop	2.79	4.62	1.52	6,209
Second crop	2.18	3.82	1.08	3,878
Third crop	1.98	3.22	1.05	2,305

The ether extract of plants consists mainly of fat and chlorophyll. In alfalfa chlorophyll very largely predominates.

"It may be more than mere coincidence that the average relative amount of chlorophyll in the leaves varies with the total dry matter produced. No such constant variation exists in the stalks or whole plant. A comparison of the total amounts of chlorophyll in the plant and its parts does not show any definite relations to the dry matter produced; it appears that the percentage, or relative force, maintained throughout the growing period, determines the amount of dry matter a crop can produce. If this relation should be proved to hold in all cases, the maximum yield of dry matter would be known when the average amount of chlorophyll in the leaves had been determined."

The residues from the ether extraction were treated successively with 95 per cent alcohol for 2 hours, and with water for 24 hours, with frequent agitation. The results follow:

Alcohol and water extracts of alfafa.

	First crop.			Second crop.		Third crop.
	Early period.	Flowering period.	Late period.	Flowering period.	Late period.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*
Alcohol extract:						
Whole plant	16.02	12.04	7.43	9.91	9.26	13.80
Leaves	14.98	13.83	13.07	12.87	13.72	16.59
Stalks	18.48	10.94	5.99	7.68	6.70	10.80
Water extract:						
Whole plant	21.93	17.64	11.34	18.45	15.61	17.66
Leaves	23.44	26.17	21.15	29.07	29.17	23.32
Stalks	19.42	12.36	8.43	10.43	7.90	11.38

The alcohol extract, according to the authors, consists of resins not dissolved by ether, tannins and their derivatives if present in the plant, alkaloids, glucosids, some proteid bodies, amido compounds and glucoses, and saccharoses if present.

Water would extract from the residue from the extraction by alcohol, "in addition to a number of rare substances, the soluble carbohydrates, such as dextrin and other mucilaginous bodies, the soluble albuminoids and the legumins, some amids insoluble in alcohol, and most of the organic and inorganic acids that may be present."

The bearing of this matter on the concentration of plant juice is discussed in some detail.

The residues from the above extractions were treated with 2 per cent hydrochloric acid under a reflux condenser for 1 hour, and then with $1\frac{1}{4}$ per cent sodium hydrate at boiling for $\frac{1}{2}$ hour. The residue from this last extraction was dried, weighed, and incinerated, the loss in incinerating being taken as fiber. The alkali extract was determined by

subtracting from 100 the sum of the ether, alcohol, water, and acid extracts and the fiber. The acid and alkali extracts follow:

The hydrochloric acid and alkali extracts of alfalfa.

	First crop.			Second crop.		Third crop.
	Early period.	Flowering period.	Late period.	Flowering period.	Late period.	
Acid extract:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Whole plant	24.92	18.59	13.65	15.96	15.90	18.34
Leaves	26.62	21.96	20.95	21.07	20.94	22.14
Stalks	21.81	15.77	11.25	12.01	13.07	13.33
Alkali extract:						
Whole plant	16.53	16.18	19.01	17.51	17.58	17.62
Leaves	16.95	17.14	23.43	19.45	19.55	20.17
Stalks	15.77	15.62	18.27	16.12	16.59	13.67

Dilute hydrochloric acid would remove from the residue of material extracted with water, starch and allied bodies and the hemicelluloses, gluten and related substances, amins, and inorganic salts. Most of these substances have a very high food value.

"Next to the crude fiber, the alkali extract is the most resistant portion of the plant. It is made up chiefly of the insoluble nitrogenous bodies of the plant, together with small quantities of carbohydrates, organic acids, and other substances. . . .

"All the errors made in the preceding determinations fall upon the alkali extract. In spite of this, duplicate determinations agree fairly well, and the results may be accepted as indicative of the truth. . . .

"The foregoing facts teach much of interest and importance concerning the conditions of solubility of the alfalfa plant at its various stages of growth. We may divide the constituents of a plant into 3 groups according to the solubility (leaving out of consideration the fat): (1) Those easily soluble (in alcohol and water); (2) those difficultly soluble (in dilute acids), and (3) those insoluble, or soluble only in alkalis (fiber, and alkali-soluble). . . .

"Considering the whole plant, during the early period more than one-third is easily soluble, about one-third insoluble, and nearly one-quarter soluble with difficulty. During the flowering period the easily soluble materials decrease to less than one-third, the insoluble increase to nearly one-half, and the difficultly soluble fall to less than one-fifth. During the late period the easily soluble portion becomes less than one-fifth, the insoluble about two-thirds, and the difficultly soluble less than one-eighth.

"The easily and difficultly soluble portions of the plant may be considered almost wholly digestible, while the insoluble portion is but slightly attacked by the digestive juices. The percentage of insoluble and alkali-soluble material during the flowering period is very nearly the same as the indigestible percentage as determined by experiments with animals. A part of the alkali-soluble portion, and of the crude fiber is, of course, digested; and some of the materials of the soluble materials are passed through the body without being digested. The decreasing solubility of the plant with age is due almost wholly to the rapid accumulation of crude fiber. It is quite certain that much of the soluble material becomes so entangled in the fiber as to be practically indigestible. During the cutting periods for alfalfa it may be said that about one-half of the plant is insoluble.

"The leaves do not change very much. They are 10 per cent more insoluble when old than they were when young. During the flowering period the leaves are as good as a cattle food as at any other time.

"The stalks are not much more insoluble than the leaves while the plant is young, but with increasing age they become insoluble very fast. During the flowering periods there is nearly 60 per cent of insoluble matter, and during the late periods more than 70 per cent. This, of course, makes the stalks very indigestible.

The carbohydrates of alfalfa (pp. 27–38).—Following the method proposed by Stone (E. S. R., 8, p. 664) the authors studied the carbohydrates in the different crops and cuttings of alfalfa. In determining starch by malt extract, however, it was found that "duplicate determinations were very discordant. . . . No matter how carefully the work was done, the results were never quite trustworthy. . . . A few preliminary tests indicated active unorganized ferments in the alfalfa after the half hour in boiling water. This part of the research, which promised interesting results, we could not continue." The method adopted by the authors was boiling with hydrochloric acid, allowance being made for the pentosans.

"The carbohydrates of alfalfa, with the exception of the fiber, are, as far as their quantity is concerned, of little importance. The general notion that every fodder plant is made up largely of sugar and starch is far from correct in the case of alfalfa. However, there can be no doubt that the carbohydrates are very important as bodies that stand intermediate between the first products of the plant's constructive activity and the compounds finally deposited within the plant.

"It is interesting to note the intimate connection between the alcohol and water-soluble carbohydrates; if one decreases the other increases, and *vice versa*. It seems as if it matters little whether sugar or dextrin be present, as either one meets the condition of solubility. A similar relation holds, in a less degree, between the starch and the pentosans. The lower sugars mark only the transformation of some body into another, within the plant, and are not characteristic ingredients."

The nitrogenous constituents of alfalfa (pp. 39–54).—The total proteid and the different nitrogenous materials in alfalfa of different crops and cuttings were studied in detail. The determination of the total protein showed that—

"The formation of protein in the whole plant does not keep pace with the increase in dry matter, but that as soon as the crop is in early bloom the proportion begins to decrease. Comparing the leaves and the stalks we see that five-sixths of the total protein was found in the leaves; that at budding time nearly nine-sixteenths, or more than half, was in the leaves; and that eight-thirteenths, or more than one-half was found in the leaves at the first period of full flower."

The determination of the relative amount of albuminoid and nonalbuminoid nitrogen showed that—

"The plant and its parts show an absolute gain of albuminoids up to the time when the crop is in full bloom. At that time material is drawn from the leaves and stalks into the roots, and the crop above ground loses some of its albuminoids. The stalks are the last to lose their albuminoids, as would be expected from the fact that the substances taken from the leaves must pass through the stem to reach the root, and the stem is thus made, temporarily, richer. The nonalbuminoids are unfinished albuminoids. It is therefore natural to find the greatest absolute and relative quantities in the young plant, when growth is active. From the time of budding there is a rapid conversion of raw materials into finished products, and during that period, therefore, the nonalbuminoids are almost entirely converted into albuminoids. The leaves, which are more or less active to the death of the

crop, contain (to the end of the season) a small proportion of nonalbuminoids, but not enough to keep an excess in the stalks, which, as a consequence, lose nearly all their nonalbuminoids after the flowering period."

Nonalbuminoid nitrogenous materials are easily soluble in water or dilute reagents. Many of the albuminoids, however, are insoluble. The proportion of soluble and insoluble albuminoids in alfalfa was determined by digesting samples with a dilute solution of pepsin and hydrochloric acid.

"In the whole plant the percentage of protein insoluble in pepsin decreases until budding time. It then remains constant for 4 weeks, or until the first week of full flower. It then falls again, but remains practically constant until the end of the experiment. . . The reason the percentage of pepsin-insoluble protein in the whole plant decreases as the plant grows older is easily understood when we recall that the ratio between the leaves and stalks is not constant, but widens as growth goes on. When, therefore, the plant is young and the leaves are abundant, the percentage of pepsin-insoluble protein is high. As the plant grows older, and the stalks increase more rapidly than the leaves, the percentage of the pepsin-insoluble protein is smaller."

The nuclein was determined in the plant, leaves, and stalks of alfalfa and other hays cut in 1897, and in wheat, peas, and alfalfa seed. The results obtained were as follows:

Nuclein in alfalfa and other plants and seeds.

Substance.	Leaves.	Stalks.	Seeds.
	Per cent.	*Per cent.*	*Per cent.*
Alfalfa second crop, young	6.78	2.93	
Alfalfa, first crop, old	6.88	2.32	
Clover slightly spoiled	9.62	2.71	
Timothy, slightly spoiled	3.15	1.10	
Wheat, very young	4.04	1.55	
Wheat, ripe	3.90		
Oats, very young	3.48	1.58	
Oats, ripe	3.46	1.29	
Wheat, 3 years old			1.35
Wheat, 1 year old			1.28
Peas			1.62
Alfalfa			7.13

"The results, taken in connection with those previously given, furnish sufficient evidence that the percentages of nuclein in the leaves and the stalks of alfalfa are invariable; that they are not affected by the age of the plant, by the season, or by the place of cutting. They show further that the leaves and stalks of other plants do not contain the same percentages of nuclein as alfalfa, though the percentages they do contain are constant. The constancy does not seem to be confined to leaves and stalks alone, for 2 samples of wheat seed, grown in different years, contain the same percentage of nuclein. Only one sample of clover was obtained, and that in an imperfect condition; the analysis can not therefore be depended on to show the truth for a perfect sample.

"The wheat contains little more than one-half as much nuclein as alfalfa, the oats contain about half as much, and the timothy less than one-half. . . .

"With these results in our possession, and until later work shall modify them, it may be stated as a law that each organ of a plant contains a definite and invariable percentage of nuclein which is different from that of any other organ, and that similar organs of different plants do not necessarily contain the same percentages of nuclein."

The function of nuclein is discussed at some length. As the author points out, nonalbuminoids can not be used in the formation of muscular tissue and the nuclein is not digested. The sum of the nonalbuminoids and the nuclein subtracted from the total protein shows the amount of true flesh formers present.

"In the whole alfalfa plant the percentage of true flesh formers decreases as the plants grow older. During the periods of budding and flowering the percentage was almost constant. The total weight per acre increased to the period of budding and then remained constant to the period of full flower; after that time there was a decrease."

The protein in the different extracts was studied in considerable detail, and the general deduction was that "in the whole plant and its parts, the protein of alkali extract is the highest, followed by the protein of the acid, water, and alcohol extracts, the crude fiber and the ether extract."

The author discusses the proximate composition of alfalfa, and the portion determined by difference in ordinary analytical methods.

The advantage of frequent cuttings is pointed out. A comparison was made of the yield obtained in various cuttings, the first of them being made very early.

"Each successive cutting becomes smaller in the yield per acre, and also in the percentage composition of the most valuable ingredients. It is therefore important to secure as much as possible of the first, and best crop. When the fact that the hay cut at medium bloom has about the same food value as that cut a week earlier, the evidence that alfalfa should be cut after budding becomes still stronger."

Digestibility of alfalfa cut at different periods of growth (pp. 55-60).—Digestion experiments made by artificial methods indicated that the average coefficient of digestibility of the total protein of the alfalfa in the whole plant was for the first crop 71, and the albuminoids 61; for the second crop the coefficient of the whole protein is 67, and of the albuminoids 61; and for the third crop about 60 and 43, respectively.

Experiments on the digestibility of alfalfa of different crops and cuttings were made with steers. The usual methods were followed. The average results are shown in the following table:

Digestion of alfalfa hay by steers.

	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
First crop; average of first, second, and third cuttings	58.78	65.07	35.00	72.41	40.15	41.62
Second crop; average of first, second, and third cuttings	60.32	70.48	42.25	71.74	44.36	46.16
Third crop	58.17	69.30	41.51	71.00	34.30	44.25
Average of all	59.64	67.99	39.04	72.36	41.12	43.94
Mixed alfalfa, 1896	60.16	70.30	50.57	71.80	45.67	40.85

The author's conclusion is that the digestibility of alfalfa remains practically constant from the time of cutting to the period of full bloom.

The time to cut alfalfa for hay (pp. 61–65).—The yield and composition of alfalfa of different crops and cuttings is discussed.

"From what has gone before we may at least draw two general conclusions; alfalfa in passing from the budding stage to the stage of first full flower decreases, pound for pound, in food value; and the acre crop, in passing through the same stages does not lose any of its beef producing power. We may hold this conclusion to be right; that to insure a large yield of dry matter and the largest amount of albuminoids, alfalfa should be cut not earlier than the period of medium bloom, and not much later than the period of first full flower. This in most cases will be 2 or 3 weeks after the flower buds begin to appear. It will be a more serious error to cut too early than to cut too late."

Appendix (pp. 67–90).—In the appendix are given in tabular form the results of the individual analyses discussed in the preceding pages.

Summary of digestion experiments with Kafir (*Oklahoma Sta. Bul. 35, pp. 4*).—A number of experiments on the digestibility of Kafir corn and Kafir corn products by steers are very briefly summarized. Two trials were made with Kafir corn, but in all other cases 4 trials were made. The coefficients of digestibility are shown in the following table:

Coefficients of digestibility of Kafir corn products by steers.

	Dry matter.	Protein.	Ether extract.	Nitrogen-free extract.	Fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Shredded Kafir stover	56.3	30.5	79.3	58.2	67.0	19.0
Kafir corn, fed dry	41.7	43.6	44.8	40.8	45.4	63.9
Kafir corn, soaked	38.0	40.2	38.8	38.0	35.2	65.7
Kafir heads	24.3	12.3	31.1	30.8	27.4	53.6
Coarse Kafir meal	64.2	53.3	46.1	75.9		
Kafir fodder	60.6	38.1	61.0	66.4	60.4	7.8

"Kafir corn stover contained as much digestible matter as corn stover.

"Kafir corn fodder contained 10 per cent less of digestible matter than corn fodder.

"Kafir corn heads contained one-third as much digestible matter as corn-and-cob meal. Kafir corn fed in the heads was neither more nor less digestible than when fed after thrashing.

"Kafir corn fed after soaking in water for 12 hours was less digestible than when fed dry. Fed dry it contained 40 per cent less digestible matter than coarsely-ground Kafir corn meal.

"Kafir corn meal, coarsely ground, contained 20 per cent less digestible matter than corn meal. It paid to grind Kafir corn. One hundred pounds of Kafir corn meal contained as much digestible matter as 160 lbs. of Kafir corn.

"A gain of 13 per cent in the amount of digestible matter was secured when Kafir corn fodder was thrashed, the grain ground and fed to steers with the shredded stover from the fodder. A gain of less than 2 per cent in the amount of digestible matter was secured when Kafir corn fodder was thrashed and the grain fed to steers with the shredded stover from the fodder."

In addition to the above, brief notes are given on the steer-feeding experiments made in 1897 and 1898.

The steers fed Kafir corn heads made an average gain of 1.85 lbs. per day; those fed Kafir corn meal, 2.36 lbs. daily. Horses, cows, sheep, and pigs have kept in good health and made fair gains when the

only grain fed was Kafir corn, although in no case were as large gains made by pigs on Kafir corn as on corn meal.

"The loss from failure to digest all the food eaten is much less when hogs are fed unground Kafir corn than when cattle are so fed. In some cases hogs made less gain on soaked Kafir corn than when it was fed dry—probably because they ate the latter more slowly and masticated it more thoroughly.

"Running whole Kafir cornstalks through the thrashing machine puts the stover in excellent condition for feeding. Cracking some of the grains in the process of thrashing tends to increase percentage digested, if fed unground.

"This station has not succeeded in getting large gains with steers fed whole cotton seed as sole grain, but making cotton seed a part of the grain ration has given good results in a number of cases.

"From May 9 to September 1 of this year 9 yearling steers on pasture made an average gain of 160 lbs. each. During September, when fed reasonably near full feed of corn, still on pasture, they averaged a gain of 73 lbs. each. Taken from pasture and put on full feed of corn meal, with dry rough forage, they made little gain for first 3 weeks of October, probably partly because of carrying less weight in stomach. . . .

"Somewhat limited trials in feeding stock melons show them to be much liked, especially by hogs. Having a fair feeding value, being well suited to serve as a corrective of the bad effects of exclusive grain feeding to hogs, their large yield and the readiness with which they can be harvested, make it probable that they may wisely be substituted for root crops in Oklahoma, in part at least."

Feeding experiments at Mains of Laithers, 1897, A. P. AITKEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 259–280*).—Experiments on the comparative value of concentrated feeding stuffs, which are in continuation of work previously reported (E. S. R., 9, p. 476), were made with 5 lots of cattle. Each lot was made up of 8 Irish-bred and 2 home-bred animals. Lots 1 to 3 contained 6 heifers and 4 steers, and lots 4 and 5, 5 of each sex. The test began January 14, 1897, and covered 16 weeks. It was preceded by a preliminary period of 1 week under the same conditions as the experiment proper. All of the lots were given 80 lbs. per head daily of turnips and oat straw *ad libitum*. Sixty pounds of the turnips were fed sliced and 20 lbs. pulped. The straw was fed in 8-lb. bundles and the amounts eaten recorded. In order to compare the concentrated feeding stuffs on a financial basis the lots were fed an amount of the different materials which could be purchased for the same price as 5 lbs. of linseed meal. Lot 1 was given per head daily 6⅝ lbs. of decorticated cotton-seed meal and dried brewers' grain 1 : 1; lot 2, 5 lbs. linseed meal; lot 3, 7½ lbs. barley bran; lot 4, 6 lbs. barley; and lot 5, 6⅝ lbs. maize. It became evident that too large an amount of barley was fed to lot 4 and the quantity was after a time reduced to 4 lbs. In every case account was taken of any uneaten residue of the ration. The feeding stuffs were all analyzed. The nutritive ratio of the rations fed the several lots was as follows: Lot 1, 1 : 5.5; lot 2, 1 : 6.3; lot 3, 1 : 8.7; lot 4, 1 : 10.8, and lot 5, 1 : 11.7. Each lot weighed about 9,800 lbs. The average daily gain per head for the different lots was as follows: Lot 1, 1.51 lbs.; lot 2, 1.47 lbs.; lot 3, 1.41 lbs.; lot 4, 1.28 lbs., and lot 5, 1.41 lbs. The experiment is reported and discussed in considerable detail.

"One of the objects of these experiments was to discover whether the feeding values of the by-fodders used were in harmony with their market prices. Last year it was found that they were pretty far out, and that linseed cake was on the whole the dearest. This year, when the amount of turnips fed was raised from 50 to 80 lbs. per head per day and the by-fodders reduced by one-fourth, the discrepancy between market price and feeding value is not so great, and linseed cake is no longer the dearest. The results of the experiment have been such as to enable us in their interpretation to take a wide range, and to afford information of a kind more valuable than can be obtained from a consideration of the mere question of price in relation to feeding value. Prices are constantly varying, and feeding value is seen to be a much more complex thing than would appear from the sole consideration of increase of live weight.

"The results of the 2 years' experiments have brought into prominence the supreme importance of the quality of the turnips grown upon the farm as a determinant of the feeding progress of the stock. The quantity eaten in 1897 was greater than in 1896, but on the other hand there was a considerable diminution in the quantity of by-fodders. On both occasions the quantity of by-fodders eaten was as much as the cattle could conveniently consume along with their turnip supply, but owing to the superior quality of the turnips the actual amount of true food derived from that source was practically doubled in the latter year, and it is to that circumstance that we must ascribe their greatly enhanced progress."

Sheep feeding experiments at Ferney Castle and Whitelaw, 1897, A. P. AITKEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 281–292*).—In continuation of previous work (E. S. R., 9, p. 477) the author reports experiments with sheep made at Ferney Castle by A. S. Logan and at Whitelaw by A. G. Spence, to compare oil cake and grain when fed in addition to a full ration of turnips. In each case the tests were made with 4 lots of 20 grade sheep. The lots were carefully selected and were regarded as very nearly uniform. The experiment at Ferney Castle began February 3, 1897, and covered 86 days; that at Whitelaw began February 5 and covered 85 days. In both tests lot 1 was fed decorticated cotton-seed cake and dried brewers' grains 1:1, lot 2 linseed cake, lot 3 bruised oats and barley 1:1, and lot 4 bruised oats and maize 1:1. The concentrated foods were given at the rate of 1 lb. per head daily, each farm being supplied from the same source. The linseed cake fed to lot 2 was after a time reduced to ¾ lb., since the amount at first fed was evidently too large.

"At Ferney Castle the sheep were penned on turnip land, and were shifted about as the land grew foul, and during the last 3 weeks they were kept on lea. They were fed all the time on Swedish turnips. At Whitelaw the lots were penned on turnip land and fed on yellow turnips till the middle of March; thereafter they were shifted onto lea, and from March 25 till the close of the experiment they were fed on Swedish turnips."

The composition of the foods is reported, as well as the amounts consumed and gains made by the different lots. At the close of the test the sheep were slaughtered and the weights of the carcasses, tallow, and wool are recorded. The average gains in weight per head for the different lots were as follows: At Ferney Castle, lot 1, 21.8 lbs.; lot 2, 21.6 lbs.; lot 3, 9.6 lbs.; and lot 4, 11.2 lbs. At Whitelaw, lot 1, 28 lbs.; lot 2, 29.1 lbs.; lot 3, 16.4 lbs., and lot 4, 14.3 lbs. The average dressed

weight for the 4 lots was as follows: At Ferney, lot 1, 69.2 lbs.; lot 2, 67.3 lbs.; lot 3, 59.6 lbs., and lot 4, 61.5 lbs. At Whitelaw, lot 1, 67.7 lbs.; lot 2, 67.4 lbs.; lot 3, 61.5 lbs., and lot 4, 61.8 lbs. The experiments are discussed in considerable detail.

"The results of the experiment are satisfactory, in that they show that there is very little difference in the feeding effect of linseed cake on the one hand and a mixture of cotton cake and dried grains on the other, when given to sheep in as great quantity as they can consume along with a full supply of turnips. As regards a mixture of oats and barley and a mixture of oats and maize, these also are fairly equal in feeding effect when given in equal quantities, although on the whole the advantage lies with the latter mixture. But oats, barley, and maize are evidently much inferior to the more concentrated by-fodders cotton cake and dried grains and linseed cake, and, as prices usually go, there is no economy whatever in feeding sheep with oats and barley. It would be better to sell these and buy concentrated fodder with the proceeds. The amounts of loose tallow and wool deserve notice. At both farms lots 1 and 2 produced the most wool, showing that the more highly nitrogenous dietary is favorable to wool production; and it is noteworthy that the oats-and-maize lot produced most tallow and least wool at both farms, not only on this occasion but also in the case of the former experiment."

The by-products of the dairy, F. B. LINFIELD (*Utah Sta. Bul. 57, pp. 197–249, figs. 9*).—In the author's opinion the usual methods of feeding pigs at creameries on milk or whey alone and finishing on grain for a short period is not satisfactory. Experiments were therefore undertaken to determine the value of skim milk and grain fed in various ways for pigs and calves.

Experiments in pig feeding (pp. 197–236).—Seven tests are reported extending over a number of years. The object was to compare the economy of feeding milk alone and in combination with grain as compared with grain alone. No comparison was attempted of the different grains fed. The composition of the foods used is reported, some of the analyses being made at the station. The first test which began June 27, 1894, covered 161 days, and was made with 2 lots of 4 and 1 lot of 2 pigs. Lot 1 was fed a ration of 1 lb. of grain to 4 of milk for the first 118 days and 1 lb. of grain to 2 lbs. of milk until the close of the test. Lot 2 was fed 1 lb. of grain to 2 lbs. of milk for 118 days and 1 lb. of grain to 1 lb. of milk for the remainder of the test. Lot 3 was fed grain mixed with water. For about three-fourths of the test the grain consisted of barley and bran 1:1; during the remainder, corn and wheat 1:1. The second test began January 5, 1895, and covered 135 days. It was made with 2 lots of 4 pigs each. Lot 1 was fed 4 lbs. of skim milk to 1 of grain until the pigs averaged 100 lbs. The proportion of skim milk was decreased as the pigs increased in weight until the pigs averaged 200 lbs., when they were fed skim milk and grain in equal amounts. Sufficient water was added to the grain to make up for the skim milk omitted. Lot 2 was fed grain mixed with water. The grain fed both lots consisted of wheat and bran 1:1. The third test, which began August 5, 1895, and covered 175 days, was made with 2 lots of 2 pigs each. Lot 1 was fed 6 lbs. of skim milk to 1 lb. of grain until the pigs

averaged 50 lbs. The proportion of skim milk was diminished, and from the time the pigs averaged 200 lbs. until the close of the test it was fed in the ratio of ½ lb. to 1 lb. of grain. The skim milk and grain were fed in the form of a mash, the necessary amount of water being used as the skim milk was diminished. An attempt was made to feed lot 2 on skim milk alone, but the supply was not sufficient for the purpose, so some grain was necessary. The amount fed was 2 lbs. per day. The grain fed both lots consisted of wheat and bran 1:1. The fourth test was made with 3 lots of 2 Berkshire-grade pigs each. It began June 15, 1896, and covered 24 days. Lot 1 was fed 6 lbs. of skim milk to 1 lb. of grain until the pigs averaged 50 lbs. each. The amount of skim milk was diminished as the pigs increased in weight. From the time they averaged 100 lbs. in weight until the close of the test 2 lbs. of skim milk was fed to 1 lb. of grain. Lot 2 was fed skim milk alone, and lot 3 grain mixed with water. The fifth test, which was a continuation of the fourth, began January 14, 1897, and covered 102 days. It was made with 3 lots of 3 Berkshire or Berkshire-grade pigs each. Lot 1 was fed 5 lbs. of skim milk to 1 lb. of grain until the pigs averaged 75 lbs. in weight. The proportion of skim milk was then diminished, 3 lbs. to a pound of grain being fed. Lot 2 was fed skim milk alone *ad libitum*, and lot 3 grain mixed with water. Tests 6 and 7 began July 7, 1897, and were made with 3 lots of 3 Berkshire and Poland China-grade pigs. The results as tabulated cover 104 days. In each test lot 1 was fed skim milk or whey alone, lot 2 skim milk or whey and grain in the proportion of 5 lbs. of milk or whey to 1 of grain, until the pigs averaged 75 lbs. in weight. The proportion was then diminished to 3 lbs. of milk or whey to 1 lb. of grain as the pigs increased in weight; lot 3, grain alone mixed with water. In all the tests except No. 6, the pigs were fed in pens. In No. 6 they were pastured, the special object being to compare pasturage with feeding in pens with lots 6 and 7. The financial statement is based on grain at 75 cts. per pound, this being regarded by the author as a fair average for the 4 years covered by the investigation. The results of all experiments, which are given in detail, are summarized as follows:

Summary of tests of feeding skim milk to pigs.

Food.	No. of tests.	No. of hogs.	Time covered by tests.	Average weight at beginning.	Average gain.	Food eaten per pound of gain.		Dry matter eaten per pound of gain	Gain per 100 lbs. milk eaten.
						Grain.	Milk.		
			Days.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Milk and grain	8	27	133	40	169	2.92	7.68	3.34	23.2
Grain	5	15	121	63	110	4.70	....	4.21	....
Milk	4	11	108	39	74	....	33.12	2.98	14.2

The experiments are discussed at length and are summarized as follows:

"(1) Skim milk when fed in combination with grain makes a very valuable food for hogs at all periods of their growth, but particularly so during the earlier periods.

"(2) Skim milk and grain in combination make a much more economic ration for hogs than either milk alone or grain alone. The milk-and-grain-fed lots required 2.58 lbs. of digestible matter, the milk-fed lots 2.85 lbs., and the grain-fed lots 3.19 lbs. to make 1 lb. of gain in live weight.

"(3) When fed in combination with grain, skim milk has 63 per cent greater feeding value than it has when fed alone, 100 lbs. of skim milk taking the place of 23.2 lbs. of grain in the former case and 14.2 lbs. in the latter.

"(4) The hogs fed on the milk-and-grain ration made much more rapid gains than either those fed on milk alone or grain alone. The time required to make 100 lbs. of gain was 79 days for the hogs fed on milk and grain, 116 days for those fed on grain alone, and 147 days when the food was milk alone.

"(5) When the skim milk and grain were fed in the proportion of 3 lbs. or less of skim milk to 1 lb. of grain, the return for the skim milk was greater than when a larger proportion was fed. When fed in the proportion of 2 lbs. of skim milk to 1 lb. of grain, 100 lbs. of milk took the place of 31 lbs. of grain, but when fed in the proportion of 4 lbs. of skim milk to 1 lb. of grain, only 24 lbs. were displaced.

"(6) Hogs fed on milk alone gained very slowly and did not keep in good health; in some cases they were off their feed so frequently that a change of feed had to be made. The milk and grain fed hogs, however, without exception, kept in good health.

"(7) Young hogs fed on grain alone did not do well and appeared to make poor use of the food they ate. The hogs on this ration required 2.92 lbs. of digestible matter to make 1 lb. of gain at an average weight of 73 lbs., and only 2.83 lbs. when they weighed 127 lbs. When the food was changed to milk and grain a marked improvement was effected in their growth and thriftiness.

"(8) Those hogs fed on milk alone or grain alone when on pasture, did much better than hogs similarly fed in small pens. The milk-fed lot, on pasture, gained 0.05 lb. more per day and required 0.54 lb. less dry matter to 1 lb. of gain than did the lot fed in pens, and the grain-fed lot, on pasture, gained 0.3 lb. more per day and required 0.88 lb. less of dry matter to each pound of gain. On the other hand, however, the hogs fed milk and grain in combination did better in the pens, gaining 0.05 lb. more per day than did those on pasture and required practically the same amount of food to make a pound of gain.

"(9) The appetite of the hogs and the palatability of the food seemed to have a very beneficial effect upon the rapidity and economy of the gain. The milk-and-grain-fed hogs ate 0.37 lb. more digestible matter per day than those fed on grain alone, and 1.46 lbs. more than those fed on milk alone. They gained 0.41 lb. per day more than the hogs fed grain alone and 0.59 lb. more than those fed milk alone. They also required 0.51 lb. less digestible matter for each pound of gain than did the hogs fed grain alone and 0.27 lb. less than the hogs fed milk alone.

"(10) Young hogs are in every way the more economic producers of pork. The hogs fed milk and grain required 62 per cent more to grow a pound of live weight when they weighed from 200 to 255 lbs. than they did when they weighed from 38 to 100 lbs. and for those hogs fed on grain alone the difference in favor of the smaller weight was 56 per cent."

Experiments in calf feeding (pp. 237–246).—Tests extending over 4 years were made with 16 calves to learn the relative value of skim milk and whole milk. In all the tests the calves were fed separately in stalls. In every case they were separated from the cow when 12 hours

old. For from 7 to 10 days all the calves were fed 16 to 18 lbs. of whole milk daily. As the calves grew older the amount given those which were to be kept on whole milk was increased to 20 to 22 lbs. per day. They were disposed of when 1 month old. Skim milk was substituted for whole milk in the ration of the skim-milk calves when they were from 7 to 10 days old, the amount fed being gradually increased. When 4 or 5½ weeks old, skim milk only was fed, the maximum amount being 25 to 27 lbs. daily. They were given water in addition to the milk. The skim-milk ration was continued until the calves were 5 or 6 months old. In every case fresh separator skim milk was used. It was kept from souring by heating, and was fed at 80 to 100° F. As soon as the calves would eat it, they were given a little dry chopped grain. The grains used were wheat and bran, barley and bran, barley, peas and bran, corn and bran, and corn. No comparison of the grains was made, but it is stated that one did not prove to be more satisfactory than another. After the calves were 2 or 3 weeks old they were given a little hay, usually alfalfa. The average results of all the tests are shown in the following table:

Summary of tests of feeding skim milk to calves.

	Food eaten (average).				Average weight at beginning.	Average gain per day.	Food consumed per pound of gain.				Ratio of dressed weight to live weight.
	Milk.	Fat.	Skim milk.	Grain and hay.			Whole milk. Milk.	Whole milk. Fat.	Skim milk.	Grain and hay.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lb.*	*Lbs.*	*Lb.*	*Per ct.*
Two calves fed whole milk	671	26.30	......	......	70	2.10	9.50	0.37	....	....	65.0
Seven calves fed whole milk and skim milk	232	9.06	536	......	76	1.77	3.60	.14	8.3	....	58.3
Seven heifer calves fed whole milk and skim milk	181	7.60	453	5.7	71	1.44	3.46	.14	8.6	0.11	....

Eight of the calves were sold for veal and the percentage of live weight to dressed weight recorded. The feeding of the heifer calves was continued. They were fed about 20 lbs. of skim milk daily with hay and grain. The food eaten and the gains made are recorded as well as the food consumed per pound of gain.

The labor cost of feeding calves and hogs (pp. 247–249).—The author discusses the cost of the labor of feeding pigs and calves.

"We find that it costs 5 hours of labor, or 50 cts., to look after 500 hogs for 1 day, or $50 to look after 500 hogs for 100 days. This is 10 cts. for 1 hog for 100 days, or for 100 lbs. gain, which gives 0.1 ct. as the labor cost of producing 1 lb. of live weight of hog. It is thus evident that when handled in large numbers, as hogs may be at a creamery, the labor is a very small item in growing the hogs. If the value of the gain was reckoned at 4 cts. per pound, the labor cost of producing the pork was but 2½ per cent of its selling price.

"The above, of course, represents almost ideal conditions, yet it is what any factory operator could do with very little outlay.

"The remarks are equally applicable to calf feeding as to hog feeding. Though perhaps it would be more difficult to feed a large number of calves than a large number of hogs. One of the best devices noticed for handling a large number of calves was a row of stanchions along one side of a pasture with a trough on the outside divided into boxes, one for each calf. At feeding times each calf was fastened in a stanchion, given his share of milk, and left there till he had gotten over his tendency to suck any of his mates. If the calves were divided into lots according to age and the lots fed separately, it would probably simplify matters."

Experiments with geese, C. O. FLAGG (*Rhode Island Sta. Rpt. 1897, pp. 181–617, figs. 25*).—The earlier work of the station with geese is cited, and experiments made in 1896 are reported in much greater detail than in the preceding Annual Report of the station (E. S. R., 10, p. 979). In the experiments with geese the eggs of different breeds and crosses were marked and the goslings when hatched were permanently marked by punching one or more small holes through the membrane of the foot. The majority of the experiments in 1897 were made with the same breeding stock as in the previous year with the addition of some African and Embden stock. A new mating was made to secure pure Toulouse goslings, and 2 crossings of White and Brown Chinas were made. The weights of the eggs at the beginning of the experimental period in January were recorded as well as the eggs laid by the different breeds and crosses. A table is given summarizing the weights of eggs laid by the different breeds in 1896 and 1897.

"Africans laid the largest eggs, averaging practically 6.7 oz. each. Embdens rank next in order, averaging 6.567 oz. each. The eggs of Toulouse geese averaged 6.3 oz. each; those from White Chinas 5.522 oz. each, and those from Brown Chinas were smallest in size, averaging but 5.415 oz. each. These averages are the result of weighing from 155 to 250 eggs in each instance, and fairly represent the difference in size in the eggs from the different breeds. Eggs from African geese would average to weigh 5.025 lbs. per dozen, which is 3.1 times the average weight of Rhode Island Red and Plymouth Rock hens' eggs as determined by weighing 10 doz. selected for hatching." (Average weight 1.62 lbs.)

The loss of weight of eggs during incubation was tested. The eggs were weighed and placed in incubators. After 7 days they were weighed and tested; those which were found to be infertile were removed. On the 22d day of the incubation period the eggs were again weighed, removed from the incubator, and placed under hens. The goslings were weighed as soon as hatched.

"The average weight of the 3 eggs from which goslings were hatched was 6.0053 oz. at the beginning of incubation, and the average weight of the goslings when hatched was 3.8913 oz., showing an average loss of 2.114 oz. during incubation. The individual losses were as follows: Egg No. 4 lost in hatching, 1.9827 oz., egg No. 6, 2.1719 oz., and egg No. 7, 2.1875 oz. The gosling from egg No. 4 was the only vigorous one, but whether the smaller amount of evaporation from that egg had any relation to the vigor of the gosling we can not say."

The average loss in weight of 12 fertile eggs was 0.3369 oz., of 9 infertile eggs 0.3437 oz., of 3 fertile eggs which hatched out goslings 0.3204 oz., and of 9 fertile eggs which did not hatch 0.3425 oz.

The percentage of goslings hatched in 1897 was in all cases low; in the author's opinion much lower than is usually secured by practical goose breeders where the breeding stock is not confined and the eggs are set very soon after laying.

"In these experiments the percentages are considerably reduced by the poor success of the White China matings, which the practical breeder should avoid. [The percentages for the year shows] that the Africans, as a breed, both males and females, have given the highest percentage of goslings from eggs set, the average for the breed being 38.09 per cent. This breed also shows the lowest percentage of infertile eggs—32.18 per cent. Toulouse rank second, Embdens third, Brown China fourth with a per cent of 28.57, and White China last with a hatch of 10.8 per cent of the eggs set."

The goslings were fed and cared for in practically the same way as in the previous year, the green feed being probably less abundant. They were weighed when about 5, 8, and 10 weeks old and the weights recorded for comparison. The weights of the different goslings are recorded in full in tabular form, and the growth of the different breeds in the different periods is discussed in detail.

"In 1897 pure Toulouse ranked first in average weight at about 5 weeks old, and crossbreds held the next three or more places. At 8 weeks old pure-bred Africans held the third place, and crossbreds held the other three of the four greatest average weights. At about 10 weeks old Africans held the first place, having the highest average weight, the daily growth being equal to 2.28 oz., as against 2.24 oz. per day for the Embden-African cross, which held first place at the same age in 1896. Crossbreds held the next three or more places at 10 weeks old. No pure White China or Brown China matings were made in 1897 and the lowest average weight recorded at each of the 3 weighings was for the White China-Brown China cross."

The loss of weight in dressing and drawing was determined with a number of geese. The figures indicate that—

"There is less than 5 per cent loss in live weight in the process of dressing for market in the case of geese, and over 13 per cent in the case of hens. . . . The greatest shrinkage between live and drawn weight is found in the case of an Embden-Toulouse cross, where the drawn weight was only 63.94 per cent of the live weight. The least shrinkage is . . . recorded in the case of the White China-Brown China cross, where the drawn weight was 76.05 per cent of the live weight. The average percentage for 19 geese from 9 different matings was 68.11, showing a shrinkage from live to drawn weight of 31.89 per cent. The average shrinkage between live and dressed weight was 4.88 per cent."

Thirteen goslings were exhibited at the Rhode Island Poultry Association Show and the percentage of skin and skin fat, flesh, bones, and offal in each was determined by Prof. Bumpus, of Brown University. The results are given in full in tabular form. The percentage of lean meat varied from 32.4 in the case of the Embden-Toulouse to 38.2 for the White China-Embden. The percentage of skin and skin fat was largest in the case of the Embden-Toulouse (21.6 per cent), and smallest in that of the White China-Embden (9.1 per cent), showing the former to have been very well fattened while the latter was the poorest among the number. The percentage of bone was smallest in the case of the

Embden-Toulouse and next lowest in the case of the Toulouse-African. The bones varied in weight from 9 oz. in the case of the Embden-Brown China cross, to 19 oz. in the Embden-African cross. "In the latter case the bones represented 7.2 per cent of the live weight. The head, feet, wings, and intestines, with the contents of the gizzard, representing the shrinkage in drawing, varied from 20.5 per cent of the live weight, in the case of a Brown China-Embden cross, to 23.9 per cent in the Embden-African cross. The percentage of offal was remarkably uniform, there being a variation of only 3.4 per cent."

The influence of one white parent in cross breeding geese is discussed at considerable length, as well as the influence of Toulouse blood in the production of goslings with yellow bills. The market quotations of geese in 1897 are summarized.

The food of man at the present time and in the future, E. BEKETOW (*Pitanie chelovyeka v ego nastoyashchen i budushchem. Moscow, 1896, ed. 2., pp. 48*).

Digestive ferments, with especial reference to the effects of food preservatives, H. LEFFMANN (*Jour. Franklin Inst., 147 (1899), No. 2, pp. 97-108*).—The experiments reported have been noted from another publication (E. S. R., 10, p. 170).

Tables for computing rations for farm animals, J. L. STONE (*New York Cornell Sta. Bul. 154, pp. 135-154*).—The terms used in discussing the composition of feeding stuffs and mixing of rations are defined. Feeding standards are quoted, and a table is given showing the amount of digestible dry matter and digestible nutrients in a number of common feeding stuffs, in quantities ranging from one pound to a number of pounds. The quantities selected are such as would prove useful in compounding rations.

The differentiating characteristics of the products of pepsin and pancreatic digestion of fibrin, V. HARLAY (*Jour. Pharm. et Chim., 6. ser., 9 (1898), No. 5 pp. 225-232*).

The curing of bacon (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 87-97, dgm. 1*).—The method of curing bacon in England is described in considerable detail, an article by L. M. Douglas in the Journal of the Royal Agricultural Society of England being quoted.

Bacon curing from the English point of view, L. M. DOUGLAS (*Agr. Gaz. New South Wales, 10 (1898), No. 12, pp. 1408-1420, figs. 2, pls. 3*).—This article, reprinted from the Journal of the Royal Agricultural Society of England, is noted above from another source.

Goose breeding, C. O. FLAGG (*Rhode Island Sta. Rpt. 1897, pp. 409-480, figs. 10*).—This is a general discussion of the subject with many references to the literature. The principal topics treated are peculiarities of geese, varieties, improvement of breeds, marking, cross breeding, the goose industry in Rhode Island, marking geese, location for breeding, mating, care of geese, feeding and management, rearing of goslings, fattening, killing, and picking, the production of mongrels, and goose raising in Sweden.

DAIRY FARMING—DAIRYING.

A feeding experiment with rations consisting of forage only and of forage and feed, E. B. VOORHEES and C. B. LANE (*New Jersey Stas. Bul. 130, pp. 16-22*).—In this experiment oats and peas fed alone were compared with the same fed with 5 lbs. of wheat bran and 3 lbs. of dried brewers' grains. One hundred pounds of the forage was used

when fed alone and 60 lbs. when fed with the grain, giving rations practically identical in the amount and proportion of nutrients. Two lots of 2 cows each were used and the feeding covered 2 ten-day periods, the lots being reversed in the second period. The 2 lots produced on the forage ration 1,021.9 lbs. of milk and 38.2 lbs. of butter fat, and on the forage-and-grain ration 1,091.4 lbs. of milk and 42.9 lbs. of butter fat, a gain on the forage-and-grain ration of 6.8 per cent of milk and 12.3 per cent of fat.

With oats and peas at $2 per ton, wheat bran at $16.50, and dried brewers' grains at $17, the milk was produced at 39 cts. per hundred on forage alone and at 46 cts. per hundred on forage and grain, or an increase of 18.7 per cent in the cost of milk production on the latter ration.

"The results of this experiment indicate that green forage of the same general composition as oats and peas may serve as an entire ration for dairy cows without injury to the animals and at a considerable saving in the cost of milk, though the yields may be slightly reduced."

Experiments with milch cows on the effect of work on the yield and composition of the milk, A. MORGEN ET AL (*Landw. Vers. Stat.*, *51* (*1898*), *No. 2-3*, *pp. 117-151*).—The experiments included 2 young cows and covered 11 periods of 14 days each. In alternate periods the cows were worked in a power machine, not exceeding 1 to 2 hours daily. It was found that as a result of moderate work the yield of milk decreased (on an average 0.7 kg. per day), this decrease being due to a diminution in the water, since the milk was more concentrated when the cows were worked. The principal effect was noticed on the percentage and total amount of fat, both of which increased, the percentage increase in the fat content being 10.7 per cent. The percentage of total solids increased, but not in proportion to the fat content, as the solids-not-fat decreased somewhat. The absolute amount of total solids decreased. There was also a decrease in all of the constituents of the solids except the fat, and especially in the case of milk sugar. Within the limits of the experiment, the larger amount of work (2 hours) did not affect the milk more than the smaller amount. There was only a slight effect noticeable on the live weight.

Composition and nutritive value of different kinds of cheese, BALLAND (*Compt. Rend. Acad. Sci. Paris*, *127* (*1898*), *No. 22*, *pp. 879-881*).—Ordinary cheese is said to contain 80 per cent of water and a larger amount of proteids than of fat. The so-called "cream" cheeses (as Neufchatel) contain from 50 to 60 per cent of water, more fat than proteids, and very little ash. "Half salted" cheeses are more solid, contain less fat and more ash (1 to 2 pér cent). Salted soft cheese contains from 4 to 5 per cent of ash, 30 to 50 per cent of water, and varying percentages of fat and proteids, according to the variety. Hard

cheeses (Chester, Swiss, Holland, Roquefort, etc.) have a more uniform composition. The water content does not exceed 30 per cent, the salt content 4 to 5 per cent, and the fat and proteids are often equal. The nutritive value of such cheese is very great, 100 gm. of Swiss cheese containing as much fat and proteids as 1 liter of milk and more than 250 gm. of meat, with 75 per cent of water. It is suggested that cheese with bread would make a good food for army uses.

Trial of milking machines, J. DRYSDALE (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 166–181, figs. 5*).—A report of a committee of the Highland and Agricultural Society appointed to conduct a trial of milking machines for a premium of £50. The manufacturers of the Murchland and Thistle machines entered the competition. The committee selected 7 farms on which these machines were in daily operation, 3 using the Murchland and 4 the Thistle. These farms were visited, the operation of the machines observed, and samples of the milk taken for testing their keeping qualities in comparison with hand-drawn milk.

The committee awarded the premium to the Murchland machine, "it having in every respect the most effectually fulfilled the conditions which they originally agreed should guide them in making their awards."

"In every instance the samples of milk drawn by this machine were found to keep satisfactorily. After a lapse of 48 hours they were found in no respect inferior to the samples of milk drawn by hand; in fact, if anything, rather superior in point of flavor. The committee regard the Murchland machine as a practical success, and are of opinion that in large dairies where there may be difficulty in obtaining milkers it may be introduced with advantage. . . . The chief defect in [the Thistle] machine is the effect it has on the keeping qualities of the milk. The committee found that in every case the milk drawn by it kept unsatisfactorily, most of the samples developing sourness and bad flavor in from 12 to 14 hours and marked or great acidity in 24 hours, while samples drawn by hand from the same cows at the same time, and kept under precisely the same conditions, remained perfectly sweet for from 36 to 50 hours."

In conclusion an illustrated description is given of the Murchland machine and its mode of working.

The persistence of bacteria in the milk ducts of the cow's udder, A. R. WARD (*Jour. Appl. Micros., 1 (1898), No. 12, pp. 205–209, fig. 1*).—In studies of the foremilk of a cow 4 or 5 species of bacteria were found, only one of which was common to the 4 teats, but "the same species were found to persist in the same teat from day to day." The milk of another cow examined on 5 occasions covering a period of 8 months showed 3 species, streptococcus predominating in all of the teats at first, and persisting throughout the trial, although it diminished in proportion. No streptococci were found in the milk of 8 other cows in the same stable.

An experiment was made in colonizing the milk cistern of a cow with *Bacillus prodigiosus*, introduced with a hypodermic syringe lengthened with a milking tube. The bacillus was found in the milk for 5 days after its introduction, although the number of colonies decreased from day to day, and the bacillus disappeared on the sixth day.

Bacteriological examinations were made of the glandular tissue of the apparently healthy udders of 6 cows, together with the foremilk of these cows just before they were slaughtered. The udders were divided arbitrarily into three parts, the teat and cistern, the middle part above the cistern, and the part above the middle. It was found by cultures that—

"The same organism frequently occurred in the foremilk and in each of the three parts of the udder. Most of the bacteria obtained in pure cultures were found to belong to one of three micrococci. . . . The evidence at hand indicates that the teats and the greater portion of the udder may normally contain bacteria. It also seems highly probable that a few at least of the organisms found in the udder remain there after each milking, becoming the progenitors of the organisms found to be present in the milk when drawn."

Bacillus typhi abdominalis in milk and butter, H. L. BOLLEY and M. FIELD (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 24, pp. 881–887*).—After a review of the literature of the subject the authors report the results of a large number of experiments in which sweet milk, sour milk, buttermilk, and butter were inoculated with typhoid cultures from different sources. These samples were examined for bacilli at different dates after the inoculation. From the results the authors conclude that typhoid bacilli may remain in butter in an active virulent condition for at least 10 days, and under many conditions probably for a much longer period, as, for example, butter containing a large percentage of buttermilk, which the experiments showed to be a good culture medium.

The presence of bacteria in butter, HORMANN and MORGENROTH (*Hyg. Rundschau, 8 (1898), No. 5, pp. 217–230*).—The authors' conclusions are as follows:

(1) The best method for detecting tubercle bacilli in butter is to inject 4 to 5 cc. of the butter melted at 37° C. into the peritoneal cavity of 3 guinea pigs. Cultures (at least 8 or 10) are made from the affected organs of the dead animals or those killed after 4 to 6 weeks, and parts of these organs are also introduced into the peritoneal cavity of 2 other guinea pigs and a rabbit. These latter animals are killed after 4 weeks, and blood serum cultures made.

(2) True tubercle bacilli not infrequently occur in butter.

(3) An acid-resistant bacteria is found in butter, which produces sickness in guinea pigs. This, however, is not likely to be mistaken for tubercle bacilli.

(4) From a hygienic standpoint the use of ordinarily prepared butter is open to question, and pasteurizing the milk or cream used for butter making is desirable.

Further contributions on the presence of tubercle bacilli in butter and cheese, HORMANN and MORGENROTH (*Hyg. Rundschau, 8 (1898), No. 22, pp. 1081–1084*).—Three additional samples of butter from different sources were tested, and one found to be infected with tubercle bacilli.

A sample of German Camembert cheese was mixed with water and injected into a guinea pig. The pig died within 24 hours of peritonitis. Fifteen samples of cottage cheese were tested, with the result that many of the animals died of peritonitis in 1 or 2 days; and 3 samples were found to be infected with true tubercle bacilli.

The rancidity of butter and the effect of pasteurizing cream on the keeping quality of butter, H. SCHMIDT (*Ztschr. Hyg. u. Infectionskrank., 28 (1898), No. 2, pp. 163–188*).—Different lots of butter from the same source were kept under a variety of conditions in light and darkness, and observations made on the germ content, the production of acid, the rancidity, taste, odor, etc. Salted and unsalted butter from unpasteurized cream and from cream pasteurized at 70 to 75° and 90 to 95° C. was used. It was found that the acidity and the germ content were appreciably lower in the salted and the pasteurized butter in proportion to the height of temperature employed in pasteurizing. Both the acidity and germ content were greater in butter kept in the dark than in the light at similar temperatures; but both were reduced by keeping in a refrigerator and increased by keeping in a breeding oven at 23° C. In sunlight with free access of air there was no increase in germ content and the germs were gradually destroyed. There was a slight increase in acidity, which is believed to be due to chemical action.

Under exclusion of air, both in darkness and diffused light, the acidity of butter from cream pasteurized at 90 to 95° exceeded that of butter from cream pasteurized at 70 to 75°. This was true of both salted and unsalted samples. The cause of this is not explained.

In general, butter with a high acidity was more or less rancid in taste and odor, but there were some exceptions to this rule, notably in butter kept in sunlight with free access of air. Such butter soon became rancid and greasy, lost its color, and was wholly inedible, although the acidity did not indicate it to be rancid, or only slightly so. Butter became rancid most rapidly in sunlight and next to that in the breeding oven (in darkness). Keeping in a refrigerator was the best protection against rancidity. Butter from ordinary cream became rancid more rapidly and to a greater degree than that from pasteurized cream, and the keeping quality of butter was increased by pasteurizing the cream at the higher temperature. Salted butter did not become rancid as soon or to so great a degree as unsalted.

The best conditions for keeping obtained in salted butter from pasteurized cream kept in a refrigerator. Such butter was normal after 15 days, only slightly rancid after 30 days, and was still edible when 70 days old.

Pure cultures for Cheddar cheese making, J. R. CAMPBELL (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 10 (1898), pp. 181–224*).—A preliminary experiment in the use of a pure culture of lactic-acid bacteria proving satisfactory, experiments were made on a practical scale at Craigley during June, July, and August, the results of which

are reported in detail. In addition to the work at Craigley one or more cultures were sent to 32 cheese makers for trial. The more than 100 tons of cheese made with the pure culture was for the most part sold at satisfactory prices, indicating "that the bacterium selected has proved suitable for cheese making, though it does not mean that this particular bacterium is absolutely the best." When the culture was used in too large quantities it had a decided tendency to quick ripening. The ripened cheese made at Craigley was good, the quality not having been injured by the culture. The flavor was good and there was an absence of "the undesirable fodder taste common to spring cheese." The cheese makers to whom cultures were sent for trial were in the main satisfied, several of them using the cultures all summer and requesting that they be supplied with the same bacterium the following season. In several cases cheese made with the pure cultures was given prizes at exhibitions.

The author discusses the cause of ripening, stating that while his investigation "does not absolutely prove that the bacterium used in the pure culture is the sole cause of ripening," some special experiments with milk cooled to 61–65° F. go "far to show that ripening is caused by the bacterium in the starter."

Trials of the pure cultures in 2 dairies for the purpose of preventing discoloration of the cheese resulted favorably "and in a third dairy discoloration ceased as soon as the culture was used."

The bacterium used in the culture "agrees in all respects with Leichmann's bacillus, but differs essentially from the *Bacillus acidi lactici* (Hueppe)." It produced no gas when cultivated in sealed bottles of milk or in deep tubes of gelatin or agar. In sterilized milk it produced "a clean sharp acid such as cheese makers desire." When grown in milk with other bacteria "it invariably grew so rapidly that the products of the others were completely masked, or else the acid which it developed destroyed or checked the growth of these undesirable forms of ferments." The bacterium was compared with those found in sour milk, whey, cheese, and pure culture for ripening cream. The form was found to be very prevalent in sour milk, whey, and cheese of fine quality, and in all of the pure cultures for butter making which were examined a lactic-acid bacterium resembling the one used by the author was found. The author gives instructions for using the culture, preparing starter, etc.:

"The main result of this investigation, so far as it has extended, may be summed up in one sentence, namely, the use of a pure bacterial culture in cheese making has been proved both successful and practicable. There is every probability that the system may with great advantage be applied—

"(1) Where there is danger of discoloration.

"(2) Where there is difficulty in getting a firm dry curd.

"(3) Where a starter of some kind is necessary, the conditions for keeping milk being at the same time imperfect.

"(4) Where there is trouble from tainted milk or tainted curd.

"(5) For the production of cheese in spring and autumn.

"(6) For securing greater uniformity in quality.

"The system is not to be recommended for dairies described as 'quick,' unless efficient means for cooling the evening's milk exist. . . .

"Though there are a number of different bacteria which produce lactic acid when grown in milk, one form may always be found predominating in ripe milk, sour whey, and good cheese.

"For the manufacture of Cheddar cheese this bacterium, and this one only, is required for the fermentation both of milk and curd, and also for the ripening process."

The author promises further investigation on the subject.

VETERINARY SCIENCE AND PRACTICE.

Anthrax in the lower Mississippi Valley (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 166–178*).—In the spring and summer of 1896 there was an exceptionally widespread epidemic of anthrax in the northern part of Louisiana and adjacent regions. Statistics of the extent of the epidemic are quoted. The epidemic is discussed, and preventive and curative remedies employed and other matters concerning the epidemic are discussed. Preventive measures are regarded as more satisfactory than curative.

"The preventive measures recommended were on two lines:

"(1) The treatment of healthy living animals by a process of vaccination which, it was claimed, would render them immune to the disease, and the application to their bodies of a preparation to protect them from flies.

"(2) The application of such sanitary measures throughout the infected districts as would tend to destroy or neutralize, so far as possible, every condition favorable to the further increase and wider distribution of the microscopical plant life which is known to be the cause of this disease."

Enzootic cerebro-spinal meningitis in horses, and hog cholera in Idaho, W. L. WILLIAMS (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 179–187*).—In 1896 many horses and pigs in Idaho were affected with diseases which were in that region believed to be due to a common cause. The author reports a number of cases studied by him. The horses were affected with cerebro-spinal meningitis and the hogs with hog cholera.

"The common supposition that the two affections—of horses and hogs—are identical and due to a common cause, is sufficiently refuted by the *ante-mortem* and *post-mortem* examinations recorded herewith. It may be added, moreover, that no clinical or historical evidence of identity could be established through other obtainable facts."

Contagious diseases in European countries (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 69–86*).—Statistics are given of the contagious diseases of animals in Great Britain, France, Norway, Belgium, Hungary, Denmark, and Switzerland.

Cattle tuberculosis, T. M. LEGGE and H. SESSIONS (*London: 1898, pp 78*).

Investigations relative to sheep scab (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 155–165*).—The article contains the reports of four inspectors who visited a number of sheep-feeding stations to find out the number of sheep fed, the conditions of the feeding stations, water, dipping vats, and the sanitary conditions of the sheds, with a view to determine whether the regulations relative to the transportation of sheep affected with scab were enforced.

Sheep scab: Its nature and treatment, D. E. SALMON and C. W. STILES (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 98–149, pls. 6, figs. 36*).—This is a reprint from Bulletin 21 of this Bureau (E. S. R., 10, p. 793).

A pneumo-enteric infectious disease of pigs in Portugal, A. R. MARTINS (*Arch. Med., 1 (1898), No. 3; abs. in Centbl. Bakt. u. Par., 1. Abt., 25 (1899), No. 2–3, p. 89*).—A study of epidemic diseases observed in swine in Portugal showed the presence of the swine plague.

Investigation of alleged rabies in Nebraska, W. H. GIBBS (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 188, 189*).—The report of a number of cases believed to be rabies, causing the loss of 14 hogs, 2 cows, 1 mule, and 1 horse, from what, in the author's opinion, was rabies communicated to them by dogs.

The identification of trichina, A. JOHNE (*Der Trichinenschauer. Berlin: Paul Parey, 1898, 6. ed., pp. XIV+170, figs. 125*).—This is described as a compendium for inspectors, meat-control officers, and veterinarians.

STATISTICS—MISCELLANEOUS.

Report of Florida Station for 1898 (*Florida Sta. Rpt. 1898, pp. 72*).—This contains reports of the director, agriculturist, chemist, biologist, horticulturist, and entomologist, parts of which are noted elsewhere, and a financial statement for the fiscal year ending June 30, 1898.

Tenth Annual Report of Rhode Island Station, 1897 (*Rhode Island Sta. Rpt. 1897, pt. I, pp. 90–93; pt. II, pp. 111–644, I–XVII*).—This includes the financial report for the fiscal year ending June 30, 1897; a brief report by the director; various articles noted elsewhere; lists of donations and exchanges for 1897 and station publications from date of organization; and an index of the bulletins and Annual Report for 1897.

Eighth Annual Report of Wyoming Station, 1898 (*Wyoming Sta. Rpt. 1898, pp. 43–63, 85–342*).—This contains reports of the director and heads of departments; the treasurer's report for the fiscal year ending June 30, 1898; and an appendix containing reprints of Bulletins 34–37 of the station on the following subjects: Fruit growing in Wyoming (E. S. R., 10, p. 44), Mechanical analysis and water content of Wyoming soils (E. S. R., 10, p. 29), Wyoming sugar beets (E. S. R., 10, p. 346), and The stooling of grains (E. S. R., 10, p. 947).

Experiment Station Work—VIII (*U. S. Dept. Agr., Farmers' Bul. 87, pp. 32, figs. 6*).—This number contains articles on the following subjects: Soil moisture, fertility of soils, cover crops for orchards, cultivating *vs.* cropping orchards, transplanting trees, fecundity of swine, food value of eggs, starch from sweet potatoes, and the toad as a friend of the farmer.

Fourteenth Annual Report of the Bureau of Animal Industry, D. E. SALMON, (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1897, pp. 727*).—This contains the report of the chief of the Bureau and a number of special articles on a variety of topics, some of them reprinted from other publications. A number of these articles are referred to in another place (pp. 992, 998). The report also contains statistics of the movement of farm animals, the range of prices in Chicago from 1891 to 1896, inspection and movement of sheep, animals imported for breeding purposes, imports of animals at quarantine stations, number and value of farm animals, and imports and exports of animals and animal products. Rules and regulations of the Bureau of Animal Industry, laws of States and Territories for the control of contagious animal diseases, and laws of States and Territories relative to dairy products, are also quoted. A list of the publications of the Bureau for the fiscal year 1897 is given.

Statistics of Ontario (*Ontario Bureau of Ind. Bul. 67, pp. 24*).—This contains meteorological observations and statistical tables on farm lands, field crops, live stock, population, etc., of Ontario compiled from the annual reports of the Ontario Bureau of Industries.

NOTES.

IOWA COLLEGE AND STATION.—P. T. Barnes, late of the New York State Station, has been placed in charge of the greenhouses. His time is divided between instruction and experimental work. The unusual cold of last winter, coupled with the light snowfall in central and southern Iowa, has caused great damage to nursery stock. This injury has come in the form of what is known to nurserymen as "root killing." In the college nurseries as well as in private nurseries thousands of trees have been killed and thousands badly injured. In the case of piece-root apple grafts the injury is confined mainly to that part of the root below the union of the scion and stock. Where roots have developed from the scion they are usually in good condition.

TEXAS COLLEGE.—Fred W. Mally, M. Sc., of Hulen, Tex., has been elected professor of entomology in the college. He will make the boll weevil the primary subject of investigation.

WASHINGTON COLLEGE AND STATION.—Plans and specifications have been adopted for the construction and equipment of Science Hall, to cost $60,000. This building will provide quarters for the departments of botany, zoology, bacteriology, agriculture, horticulture, veterinary science, and geology, and the third story will be devoted to museums. Each department will have a professor's office, a lecture room, and from one to three laboratories. The building will be of pressed brick with stone trimmings, 170 feet long by 80 feet deep, and three stories high. Ferry Hall, the boys' dormitory, will also be built, at a cost of $40,000. It will provide for from 175 to 200 students. David A. Brodie, a graduate of the college, has been chosen superintendent of the substation at Puyallup, which has been opened at State expense.

AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM FOR NOVA SCOTIA.—An act passed at the last session of the provincial legislature authorizes the purchase of land for an agricultural college and experimental farm and the erection of suitable buildings, appropriating $20,000 for the purpose. The college will take the place of the provincial agricultural school at Truro and the horticultural school at Wolfville. The grant for the maintenance of the horticultural school is to be discontinued with the establishment of the new institution. The agricultural school building at Truro was destroyed by fire in March, 1898, and considerable opposition has developed to the establishment of the college at that place. Its location has not yet been decided upon, but there is said to be a tacit understanding that it will be located in Kings County, in the western part of the province. The old agricultural school aimed to provide courses of instruction for farmers' sons, a general science course for the normal-school pupils, and to train agricultural teachers, who would receive $100 a year additional from the government for teaching elementary agricultural science in the public schools. The work of the new agricultural college is to be confined to courses in agriculture for farmers' sons, and a science school for the teaching of science to the normal-school pupils is to be established at Truro, where the normal school is located. It is expected that the new institution will be more strictly an agricultural school than a college.

EXPERIMENT STATION RECORD,

EDITED BY

A. C. TRUE, PH. D., *Director*,

AND

E. W. ALLEN, PH. D., Assistant Director—Chemistry, Dairy Farming, and Dairying.
W. H. BEAL—Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering.
WALTER H. EVANS, PH. D.—Botany and Diseases of Plants.
C. F. LANGWORTHY, PH. D.—Foods and Animal Production.
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With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

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Educational institutions receiving the benefits of the acts of Congress of July 1, 1862, and August 30, 1890, are now in operation in all the States and Territories except Alaska. The total number of these institutions is 64, of which 61 maintain courses of instruction in agriculture. The aggregate value of the permanent funds and equipment of the land-grant colleges and universities in 1898 is estimated to be as follows: Land-grant fund of 1862, $10,170,549.99; other land-grant funds, $1,204,234.44; other permanent funds, $11,816,258.16; land grant of 1862 still unsold, $3,838,219.48; farms and grounds owned by the institutions, $6,046,500.16; buildings, $15,185,476.95; apparatus, $1,916,227.85; machinery, $1,383,137.14; libraries, $1,634,190.25; miscellaneous equipment, $1,765,243.19; total, $53,632,852.25. The income of these institutions in 1898, exclusive of the funds received from the United States for agricultural experiment stations ($720,000), was as follows: Interest on land grant of 1862, $645,546.28; interest on other funds, $578,067.38; United States appropriation under act of 1890, $1,108,610.38; State appropriation (annual or regular), $1,827,924.51; State appropriation (occasional), $533,794.98; tuition fees, $480,847.32; incidental fees, $146,458.72; miscellaneous, $679,130.93; total, $6,008,-379.20. The value of the additions to the permanent endowment and equipment of these institutions in 1898 is estimated as follows: Permanent endowment, $1,424,277.64; buildings, $851,481.75; library, $105,661.11; apparatus, $132,111.90; machinery, $123,477.63; miscellaneous, $167,336.53; total, $2,796,350.97. The number of persons in the faculties of the colleges of agriculture and mechanic arts were as follows: For preparatory classes, 254; for collegiate and special classes, 1,564; total, 1,722. In the other departments the faculties aggregated 889, making a grand total of 2,611 persons in the faculties of the land-grant institutions. The students in 1898 were as follows: (1) By classes—preparatory, 6,593; freshmen, 6,016; sophomores, 4,202; juniors, 3,216; seniors, 2,506; special, 4,526; post graduate, 878; total, 31,658. (2) By courses—agriculture, 4,181; mechanical engineering, 2,797; civil engineering, 1,504; electrical engineering, 1,698; mining engineering, 554; architecture, 411; household economy, 1,298; veterinary science, 419; military tactics, 8,952. The graduates in 1898 were 2,328, and since the organization of these institutions 34,168. The average age of graduates in 1898 was 22.1 years. The total number of volumes in the libraries was 1,221,226. The total number of acres of land granted to the States under the act of 1862 was 9,559,241, of which 1,241,686 are still unsold.

Agricultural experiment stations are now in operation under the act of Congress of March 2, 1887, in all the States and Territories. Agricultural experiments have been begun in Alaska with the aid of national funds, and an experiment station is in operation in Hawaii under private auspices. In each of the States of Alabama, Connecticut, New Jersey, and New York a separate station is maintained wholly or in part by State funds, and in Louisiana a station for sugar experiments is maintained partly by funds contributed by sugar planters. Excluding the branch stations established in several States, the total number of stations in the United States is 54. Of these, 52 receive the appropriation provided for in the act of Congress above mentioned. The total income of the stations during 1898 was $1,201,921.17, of which $720,000 was received from the National Government, the remainder, $481,921.17, coming from the following sources: State governments, $341,097.94; individuals and communities, $177.20; fees for analyses of fertilizers, $54,977.30; sales of farm products, $65,356.25; miscellaneous, $20,312.48. In addition to this, the Office of Experiment Stations had an appropriation of $35,000 for the past fiscal year, including $5,000 for the Alaskan investigation. The value of additions to equipment of the stations in 1898 is estimated as follows: Buildings, $109,851.65; libraries, $11,700.73; apparatus, $19,195.43; farm implements, $10,800.27; live stock, $13,151.33; miscellaneous, $11,972.97; total, $176,469.41.

The stations employ 669 persons in the work of administration and inquiry. The number of officers engaged in the different lines of work is as follows: Directors, 75; chemists, 148; agriculturists, 71; experts in animal husbandry, 10; horticulturists, 77; farm foremen, 29; dairymen, 21; botanists, 50; entomologists, 46; veterinarians, 26; meteorologists, 20; biologists, 11; physicists, 11; geologists, 6; mycologists and bacteriologists, 19; irrigation engineers, 7; in charge of substations, 15; secretaries and treasurers, 23; librarians, 10, and clerks, 46. There are also 21 persons classified under the head of "miscellaneous," including superintendents of gardens, grounds, and buildings, apiarists, herdsmen, etc. Three hundred and five station officers do more or less teaching in the colleges with which the stations are connected.

During 1898 the stations published 406 annual reports and bulletins. Besides regular reports and bulletins, a number of the stations issued press bulletins, which were widely reproduced in the agricultural and county papers. The mailing lists of the stations now aggregate half a million names. Correspondence with farmers steadily increases and calls upon station officers for public addresses at institutes and other meetings of farmers are more numerous each year. The station officers continue to contribute many articles on special topics to agricultural and scientific journals. A number of books on agricultural subjects, written by station officers, have been published during the past year.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Methods for detecting adulterations of bone superphosphates with other superphosphates, F. DUPONT (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1898–99), No. 8, pp. 767–771*).—A summary and criticism of the methods submitted in competition for the prize of 1,600 francs offered by the Federation of Italian Agricultural Syndicates. The competitors included 4 Americans, 3 Frenchmen, 2 Italians, 1 Swiss, and 1 Austrian. The prize was awarded to H. Lasne, who submitted a detailed chemical and microscopical method for the purpose. Among those who submitted methods were A. P. Bryant (E. S. R., 8, p. 283), H. A. Huston, and F. Martinotti (E. S. R., 10, p. 219).

Estimation of pentoses, A. GRÉGOIRE and E. CARPIAUX (*Bul. Assoc. Belge Chim., 12 (1898), pp. 143–151; abs. in Analyst, 24 (1899), Feb., p. 39*).—The authors give an account of their investigations on different methods for determining pentoses, including the phenylhydrazin and phloroglucin methods. In the gravimetric phenylhydrazin method they found a small error due to the slight solution of the hydrazone in the wash water. To obviate this they devised a gas gravimetric process in which the nitrogen in the phenylhydrazin is determined before and after the precipitation, and the difference calculated into the amount taken up by the furfurol. For the determination of nitrogen in the phenylhydrazin from 4 to 4.5 gm. was dissolved in 250 cc. of water, 25 cc. of the solution mixed with 20 cc. of concentrated hydrochloric acid, boiled for several minutes to remove the air, and introduced while hot into a Schloessing apparatus containing 25 cc. of a 20 per cent solution of copper sulphate and a little hydrochloric acid. The determination was made in the usual way.

For the precipitation of the furfurol 81.5 gm. sodium chlorid was dissolved in about 400 cc. of water, 2 drops of acetic acid added and a quantity of furfurol not exceeding 0.6 gm. After the addition of an aqueous solution of phenylhydrazin (4 to 4.5 gm. in 250 cc.) the liquid was made up to 500 cc. and shaken for at least an hour. The filtrate was at once mixed with hydrochloric acid, which was found to prevent the decomposition of phenylhydrazin acetate. It was then boiled to expel the air, and 200 cc. containing 20 cc. of hydrochloric acid, was used for determining the nitrogen, in Schloessing's apparatus, this

being deducted from the amount found in the first determination. The result multiplied by the factor 3.429 gave the amount of furfurol.

In 7 analyses of furfurol by this method the percentages found varied from 99.4 to 102.4, the average being 100.5 per cent.

Contributions on the chemistry of tobacco: II. The determination of the nonvolatile organic acids in tobacco, R. KISSLING (*Chem. Ztg., 23 (1899), No. 1, pp. 2-4*).—This deals with the method and results of the determination of oxalic, citric, and malic acids in different kinds of tobacco. The results obtained are given below:

Oxalic, citric, and malic acids in different kinds of tobacco.

	Havana.	Brazilian.	Sumatra.	Virginia.	Seed leaf.	Pfalzer.	Macedonia.	Bosnia.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Oxalic acid	2.08	3.05	2.50	1.80	0.96	1.74	3.72	2.29
Citric acid	5.32	5.99	6.40	2.81	8.73	5.20	0.55	1.63
Malic acid	3.49	3.56	4.95	6.20	4.72	10.40	3.78	8.08

The averages for these acids are given as follows: Oxalic 2.28, citric 5.75, and malic 5.65 per cent.

Dictionary of industrial chemistry, A. M. VILLON and P. GUICHARD (*Dictionaire de chimie industrielle. Paris: B. Tignol, 1899, Vol. 2, No. 19*).

A treatise on quantitative chemical analysis by electrolysis, J. RIBAN (*Traité d'analyse chimique quantitative par électrolyse. Paris: Masson et Cie., 1899, pp. VI + 304, figs. 96*).

Methods of analysis adopted by the experiment stations of Belgium and Holland, F. HOLLEMANN (*Landw. Vers. Stat., 51 (1899), No. 4-5, pp. 357-365*).—The methods have been previously noted (E. S. R., 10, p. 304).

Questions which arise in the analysis of potashes, LACOMBE (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1899), No. 9, pp. 894-907*).

On the unreliability of Böttcher's method for determining citrate-soluble phosphoric acid in Thomas slag, M. PASSON (*Ztschr. Angew. Chem., 1899, No. 1, p. 3*).—The author found this method (E. S. R., 10, p. 310) to give results one-half per cent higher than those obtained with the molybdic method. This error is ascribed to the presence of silica in the precipitate.

On the insoluble residue from the treatment of Thomas slag with Wagner's solution, M. PASSON (*Ztschr. Angew. Chem., 1898, No. 21, pp. 489, 490*).—The residue, carefully washed with water, alcohol, and ether was submitted to analysis. It was found that the phosphoric acid was still dissolved to a considerable extent by citrate solutions. The phosphoric acid of the fine meal was more soluble than that of the coarse slag, but when the coarse portion was ground fine, the phosphoric acid was as soluble as in the unsifted meal.

On the determination of phosphorus and sulphur in plants and in their ashes, M. BERTHELOT (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 1, pp. 17-23; abs. in Rev. Sci. [Paris], 4. ser., 11 (1899), No. 2, p. 51*).—The ordinary methods of determining these substances, by cautious incineration or prolonged digestion in concentrated nitric acid, are stated to be very inaccurate. A much more exact method was found to be incineration in oxygen in a calorimeter, the gases produced being conducted through a long column of sodium carbonate heated to low redness to prevent loss by volatilization.

On the presence and determination of chlorin in plants, M. BERTHELOT (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 1, pp. 23-26*).—The method of determining phosphorus and sulphur described above was used successfully in the determination of chlorin.

Testing butter for foreign fats, R. WOLLNY, (*Oesterr. Chem. Ztg., 2 (1899), No. 5, pp. 124–126*).—A quite general paper on this subject, presented at the Third International Congress of Applied Chemistry, 1898.

The determination of lactic acid, F. ULZER and H. SEIDEL (*Monatsh. Chem., 18 (1898), p. 138; abs. in Ztschr. Analyt. Chem., 38 (1899), No. 1, p. 58*).

The direct analysis of sugar beets by digestion in water in the cold, J. ZAMARON (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1899), No. 9, pp. 885–887; abs. in Sucr. Ind., 53 (1899), No. 15, pp. 449–453*).

Determination of mercury in grapes, wine, lees, and marc, L. VIGNON and BARRILLOT (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 10, pp. 613–615*).

The determination of mercury in products of vines treated with mercurial solutions, L. VIGNON and J. PERRAUD (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 13, pp. 830–833; Rev. Sci.* [*Paris*], *4. ser., 11 (1899), No. 14, p. 439*).

Determination of nitrites in water, D. DE PAEPE (*Bul. Assoc. Belge Chim., 12 (1898), p. 98; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 9, p. 875*).

On the analysis of water for chemical purification, L. VIGNON and MEUNIER (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 11, pp. 683–686*).—Describes method for the determination of the free and partly combined carbon dioxid and of the amount of sodium carbonate necessary to transform the chlorids and sulphates present.

A contribution to agricultural chemistry—cardamoms, H. B. YARDLEY (*Chem. News, 79 (1899), No. 2051, p. 122*).—An analysis of the ash of cardamom seeds (with husk).

The chemistry of sassafras, C. KLEBER (*Amer. Jour. Pharm., 71 (1899), No. 1, pp. 27–32; abs. in Tech. Quart., 12 (1899), No. 1, Rev. Chem., p. 22*).—Principally a study of the essential oils.

The solanin content of potatoes; and a reliable reaction for the detection of the alkaloid, BANES (*Ztschr. Angew. Chem., 1899, No. 5, pp. 99, 100; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 3, p. 301*).

On solanin, P. CAZENEUVE and P. BRETEAU (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 14, pp. 887–890*).

Sumac and its adulterants, M. O'CALLAGHAN and J. RANDALL (*Jour. Soc. Chem. Ind., 18 (1899), No. 2, pp. 105–107*).

The chemical balance of an intensive farm, J. ERNOTTE and G. SEMAL (*L'Ing. Agr. Gembloux, 9 (1899), No. 8, pp. 476–481*).

A new form of potash bulb, W. C. ANDERSON (*Jour. Soc. Chem. Ind., 18 (1899), No. 2, p. 119, fig. 1*).

A serviceable generator for hydrogen sulphid, W. P. BRADLEY (*Amer. Chem. Jour., 21 (1899), No. 4, pp. 370–376, fig. 1*).

An apparatus for evaporation in vacuo and under pressure, A. GAWALOWSKI (*Ztschr. Analyt. Chem., 38 (1899), No. 1, pp. 30, 31, fig. 1*).

A sterilization apparatus for the laboratory, J. HAUSSER (*Bul. Soc. Chim. Paris, 3. ser., 21 (1889), No. 5, pp. 250–253, fig. 1*).

The lighting of laboratories and the heating of apparatus by carburetted air, C. MASSON (*L'Ing. Agr. Gembloux, 9 (1899), No. 8, pp. 481–483, fig. 1*).

BOTANY.

Experiments in range improvements, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circ. 8, pp. 5, fig. 1*).—The general depreciation in the stock ranges of the Southwest and the reasons therefor are pointed out. Experiments have been undertaken by the Division at two points in Texas to determine the most practical and economical way of treating natural pastures in order to again cover them with native

grasses or with better species from other regions. The plan of the experiment is as follows:

Pasture No. 1.—No treatment except to keep stock off until June 1, pasturing the balance of the season.

Pasture No. 2.—Cut with a disk harrow and kept stock off until June 1, pasturing the balance of the season.

Pastures Nos. 3 and 4 (40 acres each).—Grazed alternately, the stock being changed from one pasture to another every 2 weeks, thus allowing the grasses a short period for recovery after each grazing.

Pasture No. 5.—No treatment except pasturing until June 1 and keeping stock off the balance of the season.

Pasture No. 6.—Left as a check, without any treatment whatever except to keep stock off during the first season.

Pasture No. 7.—Dragged with an ordinary straight-toothed harrow and stock kept off during the first season.

Pasture No. 8.—Disked and stock kept off during the first season.

Although sufficient data is not available for definite statements, the outlook for an increase in the quantity of grass on these overstocked pastures is encouraging. During the succeeding seasons experiments will be made as to the practicability of sowing alfilaree, burr clover, Bokhara clover, alfalfa, sorghum, and other wild and cultivated grasses and forage plants directly on the sod without further treatment than to keep the stock off during at least the first year.

It is the expectation to carry on these experiments for at least 3 years, at the end of which time definite results are hoped to be secured which will enable stockmen to decide the best method of restoring their pastures.

On the development of the plumule and radicle of rice seed with various quantities of water in the germinating medium, T. YOKOI (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 482–487, pls. 2*).—On account of the practice of covering rice fields with water to facilitate germination, the author has made a study of the effect of such treatment on the development of the plant. Rice was grown in sand cultures to which various amounts of water were given, and the effect on the development of the plumule and radicle was noted. When allowed to germinate under water, the plumule develops 2 or 3 days before the radicle, while when the quantity of water contained in the sand is considerably less than saturation, the radicle develops before the plumule. When the percentage of water falls below 27, germination is retarded, and with it the development of the seedling. It was also observed that the radicle when surrounded with an abundant supply of water bore few or no root hairs. These observations have an important bearing on the development of plants, and it is suggested that in irrigating rice fields after sowing, only sufficient water for the saturation of the soil should be admitted until the seedlings have established themselves by their rootlets.

On absorption of carbohydrates by roots, J. LAURENT (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 20, pp. 786, 787*).—In a previous note (E. S. R., 9, p. 724) the author has shown that the roots of maize

are capable of absorbing and utilizing glucose and invert sugars. The cultures were made in sterile liquid media and served to show under the conditions of the experiment that maize will grow for several weeks in an atmosphere deprived of carbon dioxid. Check plants cultivated without glucose under bell jars gained little or nothing in dry weight during the experiment. In darkness and the presence of glucose the increase in dry weight of maize plants was considerably less than in the light, although still appreciable. Maize, as is shown, is able not only to reduce sugars but also saccharose, dextrin, and starch. The roots of wheat, maize, and peas are able to invert cane sugar sufficient for their necessities. The digestion of dextrin and starch by the roots of maize takes place slowly, and only very small quantities of glucose can be recognized in the culture; nevertheless these two substances may be taken up in appreciable quantities, two plants of maize having consumed in 34 days about 0.5 gm. of starch.

Following the same system of sterile cultures, the author shows that glucose may be absorbed by the roots of different plants and serve directly for synthesis of starch. Plants of mercury, peas, common groundsel, tropæolum, and sunflower were grown for some time in distilled water in darkness until their starch was used up. Their roots were then placed in a solution of glucose and exposed to sunlight in an atmosphere deprived of carbon dioxid. After 6 hours at a temperature from 20 to 25° C. the leaves were found rich in starch, while the check plants in distilled water did not contain any. Similar results were obtained with ivy, calendula, and round-leaved mallow by simply watering the soil in which the plants were grown with a solution of glucose.

In the different experiments it was observed that the starch first appeared in the cells surrounding the stomata, and in these cells it was last to disappear in the darkness.

Summing up his conclusions, the author states that from his studies there must be two methods of carbon assimilation—one the ordinary chlorophyll function and the other the absorption of certain chemical compounds after their digestion by the roots. This last method is entirely distinct from the carbon nutrition of fungi and plants without chlorophyll.

Investigations on the carbohydrate reserve material in bulbs and tubers, LECLERC DU SABLON (*Rev. Gén. Bot., 10 (1898), No. 117, pp. 353–369; 118, pp. 385–403; 119, pp. 447–482; 120, pp. 519–538, figs. 13*).—Studies are reported on the carbohydrate reserve material in the bulbs and tubers of *Ophrys aranifera*, tulip, hyacinth, lily, colchicum, potato, *Ranunculus bulbosus*, arum, iris, *Ficaria ranunculoides*, artichokes, dahlia, onion, asphodel, and *Stachys tuberifera*. For the most part the reserve organs studied are biennial. During the first year they form their reserves for utilization during the second year, and between these two periods there is a resting stage.

Among the plants investigated it was found that the carbohydrate

reserve material in the tubers of the potato, rhizomes of arum and iris, and the tubers of colchicum, and Ranunculus consists almost entirely of starch. Dextrin and sugar were present, but in very small quantities. In the tubers of Ophrys, the bulbs of lily, tulip, and hyacinth the reserve material consists of starch mixed with dextrin, or a mucilaginous substance more or less soluble in water. In the tubers of Ficaria the reserve consists of starch, dextrin, and nonreducing sugars. In the dahlia, which may be compared with the tulip bulbs, the starch is replaced by inulin and the dextrin by levulin. In the artichoke inulin, levulin, and nonreducing sugars are present. In the onion and asphodel mixtures of reducing and nonreducing sugars form the greater part of their reserve material.

In the reaction which takes place in the using up of the reserve material by the plant the starch is transformed into dextrin, then into nonreducing sugars, and later into reducing sugars. Dextrin is transformed into nonreducing and reducing sugars. Inulin is reduced similarly to starch, but levulin takes the place of dextrin, and the last form present is levulose and not glucose. The carbohydrate materials are directly or indirectly transformed into reducing sugar or glucose, in which form they are assimilated, the only exception in the material studied being the reserve in Stachys. In this galactan is present and seems to be directly assimilable.

The formation of the reserve material is much more complicated, since the action of diastases and the living protoplasm must be considered. It seems impossible to accelerate the formation of reserve material or to increase the proportion of intermediary products. The investigator must be content to establish the presence of compounds in the reserve organs from which the reserve material is formed. As an example, young tulip bulbs contain dextrin and nonreducing sugar. The sugar and afterwards the dextrin diminishes as the starch increases and from this it would be concluded that sugar is transformed into dextrin and dextrin into starch, but this transformation so far has not been reproduced by experiment. In most of the other plants which have starch as reserve material similar observations can be made. The sugars, especially the nonreducing sugars and dextrin, generally precede the formation of starch. On the other hand, in potatoes and arum the young tubers do not contain much sugar or dextrin and here it seems possible that the starch may be formed directly, or it may depend on substances other than sugar. Inulin and levulin are formed apparently in a somewhat similar manner to starch and dextrin. The galactan of Stachys, which is directly assimilated, is also directly formed.

The influence of mineral salts on the form and structure of plants, C. DASSONVILLE (*Rev. Gén. Bot., 10 (1898), No. 109, pp. 15–25; 110, pp. 59–68; 111, pp. 102–124; 112, pp. 161–170; 113, pp. 193–199; 114, pp. 238–260; 115, pp. 289–304; 116, pp. 335–344; and 117, pp. 370–380,*

pls. 10, figs. 5; abs. Bot. Centbl., Beihefte, 8 (1898), No. 1–5, p. 291; Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 11, pp. 856–858; Bot. Ztg., 2. Abt., 57 (1899), No. 1, pp. 54, 55).—The influence of salts on the growth of plants was investigated in a number of ways. Plants were grown in distilled water and in Knop's solution (E. S. R., 8, p. 744), and the external and internal characteristics of each plant compared. In a second series of experiments the effect of single salts was studied in the same way, comparisons being made with plants grown in distilled water and in Knop's solution. The effect of the absence of different salts from the nutrient was also noted. The plants upon which most of the experiments were conducted were seedling lupines, beans, rye, oats, wheat, maize, flax, gourds, hemp, morning glory, castor bean, sunflower, mustard, buckwheat, tomato, and young plants of the potato. For the most part, plants in the Knop solution grew well and flowered, while those grown in distilled water were much smaller and did not flower. The plants in distilled water remained alive as long as those grown in nutrient solutions, and in some cases longer, and the small amount of tissue developed by them was strikingly unlike the same tissues in the other plants in that it was differentiated to a greater degree. Plants in Knop's solution were larger and more vigorous, but there was little differentiation of tissues. There was a lack in the development of cuticular, sceleriform, and ligneous tissues when the plant was highly nourished.

The difference in growth in distilled water and Knop solution of a number of plants may be shown. The roots of bean plants grown in the nutrient solution were less lignified, and there was a great increase in vascular tissues as compared with plants grown in distilled water. In the stems the vascular bundles were more numerous. The experiments with oats were similar in their results. The oat leaves in the nutrient solution possessed a greater number of nerves and a greater development of mesophyll. The maize plants grown in distilled water had no root hairs, while those in the Knop solution were abundantly supplied with them, the air spaces were increased, and the vascular bundles were augmented. Similar results were secured for most of the other plants with which the author experimented. In all there was a marked absence of lignification when the plants were grown in nutrient solutions.

In the second part of the paper, in which the action of different salts on the growth of plants is reported, it is stated that magnesium sulphate retards growth at first but later seems essential to the development of lupines, castor beans, and hemp. The retarding effect seems to be principally shown on the roots, the main root of the castor bean being atrophied. Potassium phosphate was found indispensable to the growth of lupines, castor beans, rye, wheat, oats, gourds, and pine. In wheat and oats it favored root growth in proportion to the quantity present. Large amounts tend to prevent lodging in wheat and oats

by inducing the lignification of the central cylinder of the roots and the meristem in the lower part of the stem. Of all the modifications brought about in different plants this is the most important from an agricultural point of view.

Potassium silicate did not prevent the lodging of oats. Its effect seems exerted principally upon the flower parts and leaves of the wheat, the leaves had a peculiar bright green color and were much more hairy. The salt induces the lignification of the peripheral elements toward the top of the stem as well as in certain parts of the leaves.

The action of nitrates was found to differ with different species. These salts were necessary for the growth of pine, although they retarded the root growth. They are equally as essential for the Ipomœa although strongly injurious at first. With the lupines the early action of nitrates is advantageous, but later it is prejudicial to their best development. Potassium nitrate is injurious to the growth of wheat, oats, and eggplants in proportion to the quantity used. Calcium nitrate favors the development of tomatoes, while it retards the growth of pines. In soil cultures ammonium nitrate and potassium nitrate were very favorable to the growth of hemp and buckwheat, while sodium nitrate was injurious. It is said that nitrates, without regard to their base, give to leaves a special color which is doubtless due to the nitric acid.

Although the potassium phosphate was found to decrease the tendency of cereals to lodge, this is apparently due to the phosphate, since potash as a base is said to favor cell division, and as a consequence rapid growth, thus retarding lignification and favoring lodging. Sodium was found less active in inducing growth, but it hastens lignification of the lower part of the stem of cereals, preventing lodging. Calcium and magnesium were found to favor the growth of hemp and buckwheat. Experiments with the last two plants, it is claimed, showed the order of efficiency of the acids in the bases used to be nitric, phosphoric, and hydrochloric.

A series of plat experiments with buckwheat and hemp is also reported in which the effect of sodium and potassium chlorids, sodium, potassium, and ammonium nitrates, calcium and magnesium sulphates, potassium phosphate, ferric phosphate, and potassium oxalate on germination, growth, and yield were tested.

Sodium chlorid injured the plants in proportion to the quantity used. Potassium chlorid in proportion of 13.332 gm. per square meter favored germination, while the oxalate was injurious. The potassium chlorid favored growth in the earlier stages, but later the same quantity became detrimental. The optimum quantity at the beginning of growth proved very injurious at the flowering period. Of the nitrates tested, the sodium nitrate had an injurious effect on the growth of the buckwheat, while the others favored it. The sulphates favored growth, and in the earlier stages the influence was proportionate to the amount used.

The potassium phosphate increased growth, while the ferric phosphate had some little influence in increasing growth, but in large quantities it caused a change in the color of the leaves.

The effect of the salts on the dry weight of the plants is shown, and statements made relative to the effect of different quantities of each salt, the optimum quantity for plant growth being sought.

The summary statements in the paper must not be considered as generalizations, but to apply only under the conditions of the experiments.

Concerning the nitrogen nutrition of plants, L. RICHTER (*Landw. Vers. Stat., 51 (1898), No. 2-3, pp. 221-241, pl. 1*).—The author reports an extensive series of experiments with peas, buckwheat, mustard, and oats to study the effect of continual cropping upon the exhaustion of the soil nitrogen. The pots in the experiment each contained 3,600 gm. sand and 1,200 gm. garden soil, to which were added chemical fertilizers. In one series nitrogen in the form of calcium nitrate was added. Series of sterilized and nonsterilized, inoculated and noninoculated pots were arranged, and the results obtained with each of the three successive crops are shown in tabular form.

Photographic representations are made of average plants of the third crop, from which it appears that only the leguminous plants were able to utilize the free nitrogen of the air. An increase in the dry weight and the nitrogen was noticeable in each succeeding crop of peas, while with the nonleguminous plants there was a loss of each in proportion to the decrease in assimilable nitrogen. There was an increase noticed in the nitrogen in the soil in some cases where nonleguminous plants were grown, which the author does not seem to explain. This increase was slight for the first crop and increased with successive seedings. The plants did not seem able to utilize the nitrogen so stored. Where combined nitrogen in the form of calcium nitrate was added to the pots, in every case a loss was noted in the nitrogen balance at the end of the experiment.

The accuracy of the experiments which showed a loss of nitrogen, where that substance was given the plants in an assimilable form, was further tested the succeeding season in experiments with oats and similar results obtained. Pots containing no other plants were allowed to become covered with various algæ, and the nitrogen balance showed gains whether the experiment was conducted in light or darkness. Check pots without plants showed losses in every case.

On the assimilation of nitric nitrogen and ammoniacal nitrogen by higher plants, MAZÉ (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 24, pp. 1031-1033*).—The author conducted a series of experiments on the germination of peas, maize, and vetches grown in nutritive solutions to which were added various amounts of nitrate of soda or sulphate of ammonia, to ascertain whether these plants possess the ability of assimilating ammoniacal nitrogen. A tabular report is given of the experiments with maize in which it is shown that ammonia can be absorbed and assimilated by the higher plants.

Experiments on the effect of Nitragin and inoculation material upon lupines, W. EDLER (*Fühling's Landw. Ztg., 48* (*1899*), *No. 1, pp. 22, 23*).—A report is given of pot experiments with lupines in which soil inoculation and Nitragin inoculation were compared with each other and with plants grown in pots which did not receive any inoculating material. Fifteen pots were filled with a light sandy soil free from lime, and all were equally fertilized with phosphoric acid and potash. Five pots were inoculated with Nitragin, 5 with soil-inoculating material from Dr. Salfeld, and the others remained as checks. The yield of the several pots is given, from which it appears that as compared with the yield of grain from the untreated pots the yield of grain from the pots which received Nitragin was 38.44 per cent greater and from those receiving the soil-inoculation material 106.51 per cent greater. The yield of plants was increased 12.17 and 42.86 per cent respectively.

The same line of experiments was undertaken in the open field on clay soil. In this experiment the rows of yellow, black, white, and blue lupines were grown across the field, the different rows receiving the different inoculating materials. Some differences were noted in growth, but the experiment only tended to more firmly establish the author in the opinion that when the mechanical and chemical conditions of the soil are not suited to the growth of lupines, no addition of lupine-inoculation material will materially increase the growth of those plants.

Influence of bacterial soil on plant growth, E. GAIN (*Rev. Gén. Bot., 11* (*1899*), *No. 121, pp. 18–28*).—After briefly reviewing the general subject of relation of soil bacteria to plant growth, the author gives in some detail a report of experiments conducted to test the efficiency of Alinit in promoting the growth of cereal and allied plants. The first series was conducted with flax, the plants being grown in pots containing garden soil. The results in these experiments showed that plant growth was increased in all those pots which had been inoculated with Alinit.

Plat experiments were conducted in a similar manner with buckwheat and flax. The buckwheat was grown in garden soil and the yield from the inoculated plats exceeded that of those receiving no inoculation material, the gain in seed being 7.5 per cent and in plant 12 per cent. The plat experiments with flax which were conducted in a siliceous calcareous soil showed similar effect due to the inoculation, the proportional gains being 11.4 per cent for the total weight of the plants and 9.3 per cent for the seed.

The author states that under the conditions of these experiments it seems that Alinit exercises a very favorable effect on the total development of plants and also upon the amount of seed matured.

Section of seed and plant introduction, O. F. COOK (*U. S. Dept. Agr., Division of Botany Circ. 16, pp. 6*).—The recent transfer of this section to the Division of Botany, together with a change in the personnel of the Office, has made it desirable to supplement some of the details of the plans under which the work of plant intro-

duction is to be continued. The general purpose and methods of plant introduction have been set forth in Bulletin 21 of the Division of Forestry (E. S. R., 10, p. 927).

Meadows on moor soils of the royal forest domain Zehdenick, L. WITTMACK (*Landw. Jahrb., 27 (1898), No. 3-4, pp. 277-334*).—Fertilizer and culture tests were made and the growth of the different grasses and other meadow plants observed. The results obtained in 1896 and 1897 are given in tables and discussed. Different species of grasses are briefly noted.

Saltbush, J. VILBOUCHEVITCH (*Ann. Sci. Agron., 1898, II, No. 2, pp. 268-271*).—A note on *Atriplex semibaccatum*.

Concerning the genus Phyllactinia, E. PALLA (*Ber. Deut. Bot. Gesell., 17 (1899), No. 2, pp. 64-72, pl. 1*).—*Phyllactinia berberidis* n. sp. is described and studies are reported upon the haustoria of the genus.

Influence of light on the development of some fungi, F. GRAENITZ (*Inaug. Diss., Leipsic, 1898, pp. 74; abs. in Bot. Ztg., 2. Abt., 57 (1899), No. 7, pp. 97-99*).—Studies are reported on *Pilobus microsporus* and *Coprinus stercorarius*.

Influence of light upon the respiration of the lower fungi, R. KOLKWITZ (*Jahrb. Wiss. Bot., 33 (1899), No. 1, pp. 128-165, pls. 2*).—The effect of light upon molds and bacteria was investigated.

Specific characters of Endomyces albicans, P. VUILLEMIN (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 17, pp. 630-633*).—The author claims the discovery of ascospores in this fungus and groups under the above name all the forms of *Oïdium albicans*, etc.

Contributions to the biology of pollen, B. LIDFORSS (*Jahrb. Wiss. Bot., 33 (1899), No. 2, pp. 232-312*).

On the absorption of halogen salts of potassium by plants, E. DEMOUSSY (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 20, pp. 771-774*).—The author shows that colza is able to absorb through its roots considerable chlorin and bromin from the potassium salts containing them. A marked difference is noted between those plants which are able to absorb iodin and those not so constructed.

On contact irritability, A. J. EWART (*Ann. Jard. Bot. Buitenzorg., 15 (1898), No. 1, pp. 187-242, pls. 2, figs. 5*).

A contribution to the knowledge of the anatomy and physiology of water-secreting organs (*Beiträge zur anatomischen und physiologischen Kenntniss Wasser secernirender Organe. Stuttgart: M. von Minden, 1899, pp. 76, pls. 7*).

On the growth of root hairs and rhizoids, C. SOKOLOWA (*Bul. Soc. Imp. Nat. Moscow, 1897, pp. 167-277, figs. 3; abs. in Bot. Centbl., 77 (1899), No. 8, pp. 274-276*).

Experiments with Alinit, J. STOKLASA (*Deut. Landw. Presse, 26 (1899), No. 2, p. 13*).—The author defends his position relative to the efficiency of Alinit in aiding cereals to acquire free atmospheric nitrogen. The source through which the bacteria are said to act are the carbohydrates in the soil, the proteid material in the bacteria readily uniting with the carbohydrates and becoming available to the plant.

Field experiments with Nitragin, O. BURCHARD (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 12, pp. 200, 201*).—Reports the advantageous employment of Nitragin both as a soil and seed inoculating material for *Vicia sativa dura* when grown with oats. Gains from 25 to 124 per cent are reported.

Light a factor in sugar production, H. A. WEBER (*Jour. Amer. Chem. Soc., 21 (1899), No. 1, pp. 53-59*).—Data collected from the history of beet and sorghum culture in the United States are reported to show that the sugar content of the plant is dependent upon the amount of direct sunlight received, and hence that this factor should be taken into consideration in determining the climatic conditions most favorable for beet growing.

Influence of the mode of nutrition on the evolution of plants, P. A. DANGEARD (*Botaniste, 6. ser., 1898, No. 1, pp. 1-63*).—The origin of the differentiation between animals and plants is said to be a difference in the mode of nutrition.

Crossbreeding wheat, L. BROEKEMA (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 11 (1899), No. 128, pp. 34-37, pls. 3*).—A description of the methods and results of crossing several varieties of Dutch wheat with square-head wheat.

FERMENTATION—BACTERIOLOGY.

Potato as a culture medium, with some notes on a synthesized substitute, E. F. SMITH (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 411, 412*).—After discussing some of the advantages and disadvantages of potato as a substratum for the growth of fungi and bacteria, the author states that he considers it a very useful substance which should not be discarded. He further describes a synthesized medium which he has found free from many of the objections urged against the potato, while possessing most of its good qualities. It consists of potato starch combined with a modified Uschinsky solution. The methods for preparation of this medium, which the author has designated as "nutrient starch jelly," are fully given. It is stated that many organisms which previously made only very feeble growth, in this medium grow exceedingly well. This medium possesses excellent keeping qualities and is well adapted to the long-continued growth of many organisms, both fungi and bacteria, and is said to be particularly valuable for studying the diastatic action of various bacteria, some of which grow luxuriantly and convert starch into sugar very rapidly, while others make very feeble growth, being able to convert starch with the greatest difficulty.

Which forms of carbohydrates are required by denitrifying organisms for their vital processes? J. STOKLASA (*Ztschr. Landw. Versuchw. Oesterr., 1898, p. 371; abs. in Chem. Ztg., 22 (1898), No. 99, Repert., p. 315*).—The author's experiments indicate that xylan, which with other furfuroids occurs abundantly in straw and manure, when hydrolyzed to xylose furnishes the most natural and favorable carbohydrate food for denitrifying organisms. Arabinose is not so well suited to these organisms as xylose. The author made experiments with different carbohydrates in vegetation pots inoculated with *Bacillus denitrificans*. On all pots receiving glucose the yield of oats was normal, while on those receiving xylose the yield was almost a fourth less than in case of pots which had received nitrate of soda and superphosphate. The results on the pots to which arabinose had been applied were practically the same as with those receiving glucose.

Very different results were obtained in experiments with organisms which produce ammonia in the soil. Soils which were inoculated with *Bacillus megatherium* and *B. mycoides* in the presence of nitrates and xylose gave a higher yield of oats than those which had not been so inoculated. The author suggests that this was due to the reduction of the nitrate to ammonia and the thereby increased capacity of the soil for fixing the free nitrogen of the air. The fact that soils rich in furfuroids, especially xylan, contain only traces of nitrates is believed by the author to be due to biochemical action in the soil which quickly reduces the nitrates to ammonia. There is a large number of organisms which reduce nitrates and nitrites to ammonia.

A report on bacteriological investigations of the fermentation of tobacco, J. H. VERHOUT (*Teysmannia, 9 (1898), No. 2–3, pp. 118–144; abs. in Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 20, pp. 778, 779*).—The author gives a preliminary report on his investigations of the

micro-organisms of tobacco fermentation. Since tobacco is said to be fermented at temperatures ranging from 50 to 60° C., the investigation was confined to organisms living at this temperature. By means of agar plates cultures were made from fermenting leaves and at about 50° temperature colonies were developed. These were principally of a single species; although others were present, they were not constant. The species isolated from the fermenting tobacco leaves is a bacillus of the *subtilis* group and is spore-forming. It is 2.4 μ in length and 0.5 μ in diameter. It grows readily upon agar, nutrient gelatin, liquefying the latter, and in bouillon and tobacco decoction. Its optimum temperature for growth was about 50°, although it remained living at room temperatures. Upon proteid media it forms ammonia. The investigations are to be continued and the bacterial flora of tobacco leaves before and during fermentation fully studied.

Experiments with wine ferments in France (*Gard. Chron., 3. ser., 23* (*1898*), *No. 610, pp. 174–176*).—The use of wine ferments by the wine growers of France has been a subject of considerable earnest investigation, and it is asserted that the quality of many wines can be improved by the use of the proper ferments. Brief quotations are given from consular and other publications showing the method of employing the ferments. The directions for preparing the ferments are given, and it is stated that 1 liter of select ferment is used with the juice of from 40 to 50 lbs. of grapes for every 1,600 gal. of must. If properly made, the yeast ferments and is ready for use in 50 to 60 hours after beginning the preparation.

On the presence in germinating barley of a ferment capable of dissolving pectin, E. BOURQUELOT and H. HERISSEY (*Compt. Rend. Acad. Sci. Paris, 127* (*1898*), *No. 3, pp. 191–194*).—The authors report the presence in germinating barley of a diastase, which they have separated by drying the germinating barley at a temperature of from 30° to 35° C. The barley is then ground and macerated for 12 hours in chloroform water, after which it is allowed to settle, removed, filtered, and precipitated with alcohol. The precipitate is collected on a filter, rapidly washed with alcohol and afterwards with ether, and finally dried in a vacuum. Numerous experiments are reported in which this substance was shown to reduce pectin, and the authors state that on account of the lack of information concerning soluble ferments no positive demonstration can be made, yet it is believed a tenable hypothesis that germinating barley contains a diastase somewhat similar to amylose and trehalose, which is capable of reducing the pectin found in gentians.

Concerning some of the less known important functions of micro-organisms, C. WEHMER (*Chem. Ztg., 22* (*1898*), *No. 103, pp. 1079–1082*).—After briefly reviewing some of the more common forms of fermentation brought about by bacteria and fungi, the author enumerates a number of the less common ones, briefly describing the processes taking place. Among those mentioned are Maercker's acid method

of starch manufacture, Völker's method of starch making, the purification of boneblack in sugar refining, tannin fermentation, the fermentation of opium, the fermentation of beans when prepared somewhat like sauerkraut, the bacterial purification of city sewage, the micro-organisms present in white-lead manufacture, and the fermentations which take place in the manufacture of various dyes and coloring stuffs.

Report of the agricultural bacteriological laboratory at St. Petersburg for 1897, A. THEOKTISTOV (*Rev. in Selsk. Khoz. i Lyesor., 190 (1898), No. 8, pp. 325–353*).—The scientific activity of the laboratory was devoted to the following investigations: (1) Scientific investigations on the biology and classification of mice-killing bacteria; (2) investigation on the influence of metals on bacterial cultures; (3) investigations on sterilizing nutritive media; (4) work in pathological anatomy; (5) investigation of the conditions of the progressive decrease of the virulence of the bacterial cultures; (6) determination of the absolute virulence of various mice-killing microbes; (7) investigation on chicken cholera, and (8) investigation on new nutritive media.—P. FIREMAN.

Some little-used culture media which have proved valuable for the differentiation of species, E. F. SMITH (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 412, 413*).—The author recommends especially the following media for differentiation of various species of organisms: Uschinsky's solution; tubes of standard nutrient agar with addition of 10, 20, and 30 per cent of grape sugar; the same with 10, 20, and 30 per cent of cane sugar; nutrient starch jelly with and without various sugars, alcohols, etc.; cylinders of cocoanut flesh in distilled water; cylinders of white or yellow turnips in distilled water; cylinders of carrot in distilled water; cylinders of white sugar beet in distilled water; potato cylinders standing in several cubic centimeters of distilled water (for prolonged growth); the extension of tests with fermentation tubes so as to include also, in addition to the three sugars in common use—viz. grape, cane, and milk—the following substances: Fructose, galactose, maltose, dextrin, mannite, and glycerin.

The mineral constituents of the tubercle bacilli, E. A. DE SCHWEINITZ and M. DORSET (*Jour. Amer. Chem. Soc., 20 (1898), No. 8, pp. 618–620*).—Analysis of the ash, with comments.

Bacillus luteus sporogenes, R. F. W. SMITH and J. L. BAKER (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 21, pp. 788, 789, figs. 2; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, p. 72*).—This bacillus has been separated from 2 different samples of beet sugar. It is a long, endosporogenous bacillus, growing with great rapidity in all the ordinary artificial nutrient media, with the formation of a yellow pigment.

On the mode of action of Bacillus subtilis in the phenomena of denitrification, A. FICHTENHOLZ (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 7, pp. 442–445*).—It was found that in presence of air at a temperature of 38 to 39° *Bacillus subtilis* developed in an artificial solution which contained nitrogen only in the nitric form. Under these conditions ammoniacal fermentation takes place, the quantity of ammonia formed varying with the different phases of fermentation. When the maximum was reached the evolution began to decline.

Vinegar bacteria, W. HENNEBERG (*Ztschr. Spiritusind., 21 (1898), No. 20, pp. 180, 181; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 7, p. 684*).

The micro-organisms of spoiled wine, F. BORDAS, JOULIN, and RACZKOWSKI (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 20, pp. 1443–1446*).—The authors describe a second bacillus which they have isolated from spoiled wine. It is associated with *Bacillus roseus vini*. It is filamentous in form and exercises a marked action on tartaric acid. The authors have made cultures of the organism and compare its action on various culture media with the action of *B. roseus vini*.

Concerning the ferments of wine diseases, J. LABORDE (*Compt. Rend. Acad. Sci. Paris, 126 (1898), No. 17, pp. 1223–1226*).—A preliminary report is given of a study by the author of the organisms found in moldy or bitter wine aside from the yeasts and species of Mycoderma found in new wines.

Biological investigations of Tibi, L. LUTZ (*Bul. Soc. Mycol. France, 15 (1899), No. 1, pp. 68-72*).—An account is given of this substance, which is of the nature of kephir. It is said to be used in Mexico in the preparation of a beverage by the fermentation of an Opuntia.

Study on ammoniacal fermentation and on the ferments of urea, P. MIQUEL (*Étude sur la fermentation ammoniacale et sur les fermentes de l'urée. Paris: Carré et Naud, 1898, pp. 325, pls. 3, figs. 7*).

Lactic acid in fruit and grape wines, H. MÜLLER-THURGAU (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 23, pp. 849-854*).—The presence of lactic acid in many of these wines is pointed out, the way in which the content is increased through fermentation is shown, and directions are given whereby much of this undesirable fermentation may be prevented.

Contributions to the biology of wine yeasts, J. A. CORDIER (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 17, pp. 628-630*).—The author claims that in France the air is the principal agent of distribution of Saccharomyces and other wine ferments, and not insects, as claimed by Berlese, Gigliolo, and others (E. S. R., 10, p. 123).

On the natural dissemination of wine yeasts, L. BOUTROUX (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 24, pp. 1033-1036*).

A contribution to the knowledge of the life history of Saccharomyces guttulatus, A. WILHELMI (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 9, pp. 353-361; 10, pp. 412-417, figs. 3*).—Studies are given of this parasite taken from the stomach and intestines of sheep.

Some recent observations on Saccharomyces guttulatus, L. BUSCAGLIONI and O. CASAGRANDI (*Malpigia, 12 (1898), No. 1-2, pp. 59-75, pl. 1*).

Proteolytic enzyms in the plant world, C. FERMI and BUSCAGLIONI (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 1, pp. 24-27; 2, pp. 63-66; 3, pp. 91-95; 4, pp. 125-134; 5, pp. 145-158*).

On the chemistry of the action of enzyms and bacterial substances, N. SACHAROFF (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), No. 18-19, pp. 661-665*).

Diastatic substances from fungus growths, J. TAKAMINE (*Jour. Soc. Chem. Ind., 17 (1898), No. 2, pp. 118-120*).

Simple quantitative determination of diastatic power, J. TAKAMINE (*Jour. Soc. Chem. Ind., 17 (1898), No. 5, pp. 437, 438*).

Researches on diastase and barley malt, SEYFFERT (*La Bière, 6, No. 5, pp. 68-73; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 7, pp. 681, 682*).

Notes on taka diastase, W. E. STONE and H. E. WRIGHT (*Jour. Amer. Chem. Soc., 20 (1898), No. 9, pp. 639-647*).—This paper presents the results of some observations upon the action of taka diastase upon starch as compared with the ordinary diastase of malt. The use of taka diastase as an analytical reagent in the determination of starch was also tested, but under the conditions employed it was not found to be adapted to this purpose.

Fermentation without live cells, KATHERINE E. GOLDEN and C. G. FERRIS (*Proc. Amer. Assoc. Adv. Sci., 27 (1898), p. 417*).—The authors summarize the rather extensive and contradictory literature beginning with that of Büchner in 1897, who claims to have induced active fermentation of various sugars with a sterile extract obtained from dried yeast by filtration through a Berkfeld filter. Büchner's method was followed in the preparation of the extract and although the experiments were repeated three times at temperatures of 37.5° C., as well as at room temperatures, the results were negative in every case. The experiments were then repeated with another compressed yeast, with also negative results.

METEOROLOGY—CLIMATOLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 26 (1898), No. 10, pp. 439-492, charts 11; 11, pp. 493-525, charts 12; 12, pp. 527-591, charts 12*).—In addition to the

usual reports on forecasts and warnings and on weather and crop conditions, and meteorological tables and charts, No. 10 contains special contributions on A record of some kite experiments, by W. A. Eddy; The effect of proximity to the sea on thunderstorm periods, by H. D. Stearns; Removal of Weather Bureau office in New York City, by A. J. Henry; Hot summers and cold winters at Washington, D. C., by F. Gillam; and In memory of Prof. William Ferrel, by P. Connor; and notes by the editor on American climatological publications, notes from the voyage of La Pérouse, lightning on wire fences, and the utilization of fog.

No. 12 contains special contributions on The thunderstorm of September 17–18, 1895, Local atmospheric disturbances, and Are our winters changing? by A. J. Henry; Meteorological observations near Circle City, Alaska, by J. O. Holt; What a weather observer should know, by N. R. Taylor; The San Diego waterspout, by F. A. Carpenter; The weather and storms of Malta during October, 1898, by J. H. Grout; Aneroid barometers, by C. Chree; Civil-service examinations for observers in the United States Weather Bureau, by H. H. Kimball; and Climate and crop report, season of 1898, Alaska section, by H. L. Ball; and notes by the editor on reduction to standard gravity, the practical side of Weather Bureau work, the chemical thermoscope, kite work in Madeira, origin of tornadoes, meteorology in France, the climate of Athens, astronomy for the meteorologist, electrical districts, origin of the word "blizzard," seismic noises, mirobia and seiches, a new elementary meteorology, the Royal Meteorological Society, Civil-service examinations for assistants, St. Elmo's fire, ball lightning, cloud phenomena at sunrise and sunset, distant thunder, a new style of aneroid, low pressures and tidal waves, floating spider webs, the barograph on ships, weights and measures in Porto Rico, the waterspout of September 29, a crude hygrometer, the Weather Bureau and the universities and colleges, Chinook at Havre, Montana, northers in the Caribbean Sea and the Gulf of Mexico, recent earthquakes, the moon and the weather, unequal distribution of snow, recent meteors, and optical phenomena.

Meteorology of 1897, L. G. CARPENTER ET AL. (*Colorado Sta. Bul. 49, pp. 3–55, 66–70, figs. 17*).—This bulletin gives descriptions (with illustrations) of various instruments used in meteorological observations and tabulated summaries of daily observations on temperature, barometric pressure, precipitation, humidity, radiation, sunshine, direction and movement of wind, etc., at Fort Collins during each month of 1897, with monthly summaries of observations (especially temperature and precipitation) at Rockyford, Cheyenne Wells, Estes Park (at base of Longs Peak, elevation 9,000 ft.), Pinkhampton (elevation 8,400 ft.), and Gleneyre (near head of Laramie River, elevation 8,000 ft.). The monthly precipitation is reported by voluntary observers from 4 additional points in the watershed of the Cache a la Poudre River. "These stations have been selected in most cases for the purpose of obtaining a record of the precipitation in the mountains which form the watershed of the adjacent rivers. As the Cache a la Poudre River has been

the subject of investigations for a number of years and records have been maintained of its flow, it has been desired to study the amount and distribution of the precipitation on its watershed."

The characteristics of the Colorado climate are briefly discussed as follows:

"The great variation in altitude in the State, ranging from less than 4,000 ft. at the eastern border to over 14,000 ft. at the summit of numerous peaks, causes a change in climate greater than between New Orleans and Winnipeg, and while Colorado east of the mountains has a mean temperature the same as New York, the temperature of the high peaks is lower than that of Spitzbergen. . . . Still, cultivated and irrigated Colorado is of relatively small range in elevation . . .

"Among the general characteristics of Colorado are: The small rainfall—from one-half to one-third of that east of the Mississippi . . . ; greater range of temperature; a large percentage of sunshine, of great intensity, which, as well as the great range, is a consequence of the great dryness and rarity of the air.

"One of the marked features is the presence of warm westerly winds known as Chinooks, a type present in mountainous countries under various names. While cold waves are not absent, the intensity is less than in the Mississippi Valley States. The conditions which result in blizzards of great intensity in these States cause westerly winds with us and some of the most pleasant weather of winter."

Meteorological summary for Ohio, 1897, C. A. Patton (*Ohio Sta. Bul. 95, pp. 327-342*).—Notes on the weather and tabulated daily and monthly summaries of observations at the station on temperature, precipitation, cloudiness, direction of the wind, etc., are given; and for comparison similar data for previous years and for other parts of the State. The following is a summary of results:

Summary of meteorological observations in Ohio.

	For the experiment station.		For the State.	
	1897.	For 10 years.	1897.	For 15 years.
Temperature (° F.):				
Mean	49.4	48.9	50.6	50.88
Highest	(July 4-5) 96	(Aug. 8, 1891) 99	(July 4) 113	(July 4, 1897) 113
Lowest	(Jan. 26) —18	(Jan. 20, '92) —20	(Jan. 26) —27	(Jan. 25, '84) —34
Range	79	99.7	140	147
Mean daily range	21.5	20.3	....	....
Greatest daily range	(Oct. 5) 49	(Oct. 6, 1895) 55	(Sept. 25–26) 67	(Sept. 25-26, '97) 67
Least daily range	(Feb. 6) 0	(Feb. 6, 1897) 0	....	....
Clear days	124	119	130	118.3
Fair days	123	124	119	123.3
Cloudy days	115	117	116	124.7
Days rain fell	128	125	110	124.7
Rainfall (in.):				
Total	36.16	38.94	38.54	37.98
Greatest monthly	(Nov.) 5.76	(July, 1896) 8.05	....	....
Least monthly	(Sept.) 0.29	(Sept., 1897) 0.29	....	....
Mean yearly	....	....	38.54	37.98
Prevailing direction of wind	NW.	SSW.	SW.	SW.

Evaporation, L. G. Carpenter et al. (*Colorado Sta. Bul. 49, pp. 64–66, fig. 1*).—A record is given of continued observations on a standard evaporation tank.

"Observations with the hook gage are made twice per day from April to September, gage reading to $\frac{1}{1000}$ of a foot. At the same time the temperature of the water surface is observed twice per day at the maximum and minimum temperatures. During September and October the reading is made once daily. During the winter months ice forms, and the observation is made at the beginning of each month.

"It is found that the evaporation runs from 1 to 2 in. per month during the winter. The evaporation during the night is practically as rapid as during the day.

"An attempt was made to obtain a formula from the observations of 1889 and with enough success to compute the evaporation in 1890 from May to October with a difference of less than half an inch. The formula was as follows:

"$E = .39\ (T - t)\ (1 + .02W)$.

"E represents the evaporation in inches in 24 hours.

"T is the vapor tension corresponding to the temperature of the surface of the water.

"t is the vapor tension corresponding to the temperature of the dew-point at that time.

"W represents the number of miles of wind in the 24 hours.

"Observations have since been made to obtain a more perfect formula, but are not yet reduced."

Elementary treatise on meteorology, A. ANGOT (*Traité élémentaire de météorologie. Paris: Gauthier-Villars, 1899, pp. VI+412; rev. in Nature, 59 (1899), No. 1535, pp. 505, 506*).

Instructions for voluntary observers, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau Doc. 184, pp. 23, figs. 9*).—This contains brief instructions for the guidance of voluntary observers in taking and recording observations, more especially of temperature and rainfall.

Meteorological record for 1897 (*New York State Sta. Rpt. 1897, pp. 619–627*).—Tabulated daily and monthly summaries of observations on temperature and monthly summaries of observations on precipitation for the period from 1882 to 1897.

Report of the meteorologist, A. M. HILDEBRANDT (*Texas Sta. Rpt. 1898, pp. 1134–1136, charts 5*).—Tabulated monthly summaries of observations at the station on temperature (1897) and precipitation (1891–1897). Charts show graphically the daily and mean annual rainfall for 1891 to 1897.

The rainfall of the globe, W. ULE (*Rev. Sci. [Paris], 4. ser., 11 (1899), No. 13, p. 412*).—The mean rainfall of the different grand divisions of the earth is given and discussed.

Extraordinary hailstorms, G. DE ROCQUEGNY-ADANSON (*Rev. Sci. Bourbonnais, 12 (1899), No. 135, pp. 62–67*).—Brief accounts are given of some of the more important hailstorms from 1776 to date.

Sun spots and weather, A. B. MACDOWALL (*Nature, 59 (1899), No. 1533, p. 462, figs. 2*).—A comparison of the number of warm and dry months since 1841 with sun spots.

Relation of meteorology to forestry in Michigan, R. C. KEDZIE (*Michigan Sta. Bul. 162, pp. 18–31*).—After stating the relation of meteorology to forestry and forest growth, relation of soil to moisture, etc., abstracts are given of the meteorological observations covering a period of 34 years, from 1864 to 1897.

AIR—WATER—SOILS.

Investigations concerning the influence of the mechanical working of the soil on its fertility, E. WOLLNY (*Forsch. Agr. Phys. [Wollny], 20 (1898), No. 3, pp. 231–289*).—Results of previous work in this line have been published heretofore (E. S. R., 7, p. 569). In this article the purpose of the experiments is explained and the results are given in tabular form and discussed at some length. The results obtained by other investigators are cited. The subjects discussed are the mechanical condition of the soil as affected by stirring, the frequency and time of cultivation, the stirring of the surface soil, the use of the land roller, and bed and level culture. Various crops were grown in connection with the different tests. It was found that all crops grown gave better

returns on soils kept in a crumbly condition than on soils reduced to a powder-like fineness, and that the action of fertilizers was also much more evident on the former than on the latter soils. The author recommends fall plowing for land which is to be planted in the spring. It is shown that stirring or hoeing the surface is beneficial when the soil has been packed by rains and that the practice is detrimental during drought when the soil is already in a good mechanical condition. The results of tests show that rolling the land favored a uniform sprouting of the seed, but in general the yield of the rolled plats was smaller than on the plats which had not been rolled. Packing the surface soil by means of a roller was detrimental to plant growth when the soil was not subsequently stirred, but cultivating the soil after rolling precluded any bad effects from this source.

A comparison of bed and level culture gave the following results: The yields of plants on bedded plats was greatest at the ridges and smallest at the furrows; the south side of beds gave the best results, followed by the east, west, and north sides in the order mentioned; the south side of beds running east and west produced larger yields than the north side when moisture conditions were favorable, but during dry seasons the north sides gave the best returns. In general the results were in favor of level culture.

Report on fertilization, W. MAXWELL (*Rpts. Hawaiian Expt. Sta., 1898, pp. 1–14*).—This article discusses the fertilizing constituents of upland and lowland Hawaiian soils soluble in hydrochloric acid, water, and aspartic acid (E. S. R., 10, p. 531); the fertilizing constituents removed from the soil by the sugar-cane crop; the absorptive power of soils for different fertilizing chemicals and the influence of the latter upon the lime content of the soils.

Of 227 gm. of nitrate of soda applied to the soil in a lysimeter, water applied after 48 hours removed 180.3 gm. Of like amounts of potash and phosphoric acid, water removed 43.6 and 3.2 gm., respectively. In a second experiment, of 200 gm. nitrate of soda applied, water removed as nitrate 72.56 gm.; of 200 gm. of sulphate of ammonia applied, water removed 3.08 gm. as nitrate and 0.44 gm. as ammonia.

"In connection with the lysimeter observations, tests were made in order to note the action of the different acids in applied fertilizers upon the lime in soils. The acids used were nitric acid (as nitrate of soda), hydrochloric acid (as chlorid of potash), and sulphuric acid (as sulphates of ammonia and potash). These several salts were applied and 48 hours later the rows of cane, growing over the lysimeter drains, were irrigated, 102 gal. being applied to each row, of which 33 gal. leached out, this drainage being analyzed—

Analyses of drainage water from soil receiving different fertilizing chemicals.

Drain.	Acid applied.	Acid lost.	Lime lost.
		Gm.	*Gm.*
No. 1	No acid		1.72
No. 2	Nitrate of soda	36.28	26.52
No. 3	Chlorid of potash	78.06	23.49
No. 4	Sulphate of ammonia	14.88	5.49
No. 5	Sulphate of potash	2.80	2.73

"When nitrate of soda is put into the soil, it is changed to nitrate of lime, which is highly soluble in water. The result is that if we put nitrate of soda where it will be washed out, it carries so much lime with it, so that nitric acid, despite its great value in special cases, is a lime robber. The same is shown concerning hydrochloric acid in the chlorid of potassium. . . . On the other hand, very much less of the sulphuric acid is washed out, and extremely little lime. This is a further claim in favor of the use of sulphate of ammonia. The former figures showed us that the ammonia is not washed out and we now see that the sulphuric acid in the ammonia sulphate does not act in causing a loss of lime as do the other two acids."

Investigations in moor culture, H. IMMENDORFF (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 503-524*).—The work here reported consisted of investigations on the amount of plant food taken from moor and sandy soils by the removal of the grass and sod, and of analyses of *Molinia cœrulea* and *Carex goodenoughii* and various crops for green manuring grown on upland moor and light sandy soils. The composition of the different plants is given in tables.

The grass and sod of moor lands are used for litter, and investigations were made to compare the amount of plant food removed from different kinds of soil by this practice. In this experiment 2,858 kg. of dried substance per hectare was removed from the sandy soil and 21,231 kg. from the moor soil. The substance taken from the sandy soil contained 179.657 kg. nitrogen, 72.693 kg. lime, 31 kg. magnesia, 53.394 kg. potash, and 22.416 kg. phosphoric acid, and the substance removed from the moor soil 201.482 kg. nitrogen, 89.170 kg. lime, 40.339 kg. magnesia, 33.917 kg. potash, and 19.108 phosphoric acid.

Action of lime and calcium carbonate on certain natural humus substances, G. ANDRÉ (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 13, pp. 446-448; abs. in Ann. Agron., 24 (1898), No. 12, pp. 605-607; Rev. Sci. [Paris], 4. ser., 10 (1898), No. 15, pp. 471, 472*).—In the author's experiments samples of vegetable mold, moor soil, compost, and peat were heated for 15 hours in a water bath at 100° C. with lime, calcium carbonate, and water. The ammonia volatilized was collected. The extracts obtained were filtered, neutralized with hydrochloric acid, evaporated to dryness, and the nitrogen determined in the residues. The same substances were treated with lime in the cold for 82 days, with frequent shaking to promote the action of micro-organisms. Closed flasks were used to prevent loss of ammonia, and at the end of the period the alkaline solution obtained was distilled to determine the nitrogen in form of ammonia and easily transformed amids.

The amount of ammonia volatilized by lime at 100° C. was smaller than in previous experiments with potash (E. S. R., 10, p. 830), but was considerable. With potash 17.01 per cent of the total nitrogen originally present in peat, 15.96 per cent of that in compost, 14.93 per cent of that in moor soil, and 13.61 per cent of that in vegetable mold, was driven off as ammonia, as against 10.86, 12.10, 9.23, and 10.45 per cent respectively with lime. The amounts of ammonia driven off in case of calcium carbonate and water were not important except in case of peat and compost. In these 2.89 and 5.33 per cent respectively were volatilized

in case of calcium carbonate and 2.38 and 3.75 per cent respectively in case of water.

The soluble nitrogen found in the lime solution was 19.50 per cent of the original nitrogen in case of vegetable mold, 21.26 per cent in case of moor soil, 40.91 per cent in case of compost, and 16.56 per cent in case of peat. These are all much lower percentages than were found in previous experiments with potash above referred to. The solutions obtained after treatment with calcium carbonate and water also contained considerable amounts of soluble nitrogen—1.82 and 1.23 per cent of the original nitrogen in case of peat, 6.4 and 5.61 per cent in case of vegetable mold, and 16.91 and 17.4 per cent in case of compost. The calcium carbonate extract of moor soil contained 6.74 per cent of the original nitrogen.

By the action of lime for 82 days at ordinary temperature 6.59 per cent of the original nitrogen in vegetable mold, 5.56 per cent of that in moor soil, 6.91 per cent of that in compost, and 5.73 per cent of that in peat was obtained in the form of ammonia and easily decomposed amids. These figures afford an indication of the changes brought about in soils by liming.

Contribution to the solution of the question whether the water content of the soil influences the nitrogen and ash content of the dry matter of plants, J. Wilms and C. von Seelhorst (*Jour. Landw., 46 (1898), No. 4, pp. 413–426*).—A continuation of work previously reported (E. S. R., 10, p. 737). Oats were grown in pots of soil (about 17 kg., dry), which were either unfertilized or received different combinations of the 3 essential fertilizing constituents[1] and were watered at 3 different rates: (1) 41.6 per cent of the water capacity of the soil (small); (2) 45.2 per cent, increasing with the growth of the plants to 47.4 and 51.7 per cent (medium); and (3) 48.8 per cent, increasing to 53.2 and 63.7 per cent with the growth of the plants (large). The crop was cut when the grain was in the milk and nitrogen and ash determined.

It was found that the more productive the soil the greater the influence of its water content. The yield of straw and of grain was about equally increased by an increase in the water content of the soil. The influence of nitrogen in increasing the yield of straw was not affected by increasing the water content of the soil. However, with an excess of potash in the soil, increasing the water content increased the yield of straw and reduced the yield of grain. Increasing the water content reduced the nitrogen content of grain and straw to about the same extent. The nitrogen content of the crop varied with the amount applied in the fertilizer, and the effect of the nitrogenous fertilizers on the nitrogen content of the crop was greater the larger the amount of water present. The variations in nitrogen content due to the water

[1] Potash in form of carbonate, phosphoric acid in monocalcium phosphate, and nitrogen in nitrate of soda.

supply were more marked in the case of the straw than in the case of the grain.

The ash content of the grain varied with the amount of water in the soil, increasing rapidly up to the point of medium water supply, but more slowly beyond that point. The fertilizing which gave the lowest yield of grain produced grain with the highest percentage of ash. The variations in the ash content of the straw due to the amount of water did not in all cases run parallel with those in the grain, but the variations due to fertilizing were of the same character in the straw and in the grain.

The potash content of the grain increased with the water content, rapidly at first, but more slowly with the larger amounts of water. The potash content of the grain increased with the amount of potash applied in fertilizer, as well as with the amount of water in the soil. The phosphoric acid content of both grain and straw was influenced to a much less extent than potash. However, the phosphoric acid content of the grain, as a rule, increased with the amount of water in the soil, the only exception being the cases in which combinations of phosphoric acid with nitrogen and phosphoric acid with potash were applied. The phosphoric acid content of the straw also increased, as a rule, with the water content of the soil, the only exception in this case being the crops to which potash, nitrogen, and double doses of phosphoric acid (2 gms. per pot) and potash and phosphoric acid with double doses of nitrogen (1 gm. per pot) were applied. The fertilizing influenced the potash content of the straw in the same manner as that of the grain, the potash content being especially large in the crops grown without fertilizers and with potash and nitrogen. The fertilizing exerted but little influence upon the phosphoric acid content of the grain, the increase being noted only when one of the other fertilizing constituents was lacking and the yield for that reason was small.

The forms of phosphoric acid in moor soils, G. NANNES (*Jour. Landw., 47 (1899), No. 1, pp. 45–48*).—The ether-alcohol, hydrochloric acid (2 per cent), and ammonia (10 per cent) extracts of moor soils were studied. The ether-alcohol extract contained very little phosphoric acid, indicating the presence of only insignificant amounts of lecithin in the soil. More than half of the phosphoric acid present was insoluble in hydrochloric acid and ammonia (0.2 per cent out of a total of 0.38). Of the phosphoric acid extracted, 0.05 per cent was free and 0.13 per cent was combined with humus.

Attempts were also made to prepare and study the calcium, barium, cadmium, and lead compounds of humus, but without very definite results.

On the direct transformation of ammonia into nitric acid in liquid media, E. DEMOUSSY (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 9, pp. 566–569; Ann. Agron., 25 (1899), No. 3, pp. 97–111*).—The author calls attention to the fact that while it is recognized that both nitrous and nitric ferments are involved in the transformation of

ammonia into nitrates in the soil, it is rare that any nitrites are found to be present in the soil. In artificial liquid media, however, the action of the nitric ferment appears to be slower, as a rule, than that of the nitrous ferments, and nitrites thus accumulate more or less. The author succeeded, however, in preparing liquid media in which the ammonia was transformed directly into nitrates without the intermediary of nitrites.

Alkali studies, II, E. E. SLOSSON and B. C. BUFFUM (*Wyoming Sta. Bul. 39, pp. 35–56*).—In this bulletin the character of Wyoming alkali, studies of the effect of alkali on the germination of seed, field experiments on alkali soils with different plants, and the reclamation of alkali soils are discussed in a popular manner. In Wyoming alkali the sulphates predominate, black alkali being very rare in the State. The experiments made by the station indicate that the retarding effect of alkali on the germination of seeds is due to its hindering the seed from absorbing the water needed, and that this absorption "was influenced not by the kind of alkali or the strength of the solution, but purely by the osmotic pressure." In an experiment with wheat to test this point the following results were obtained:

Amount of water absorbed by wheat from salt and sugar solutions.

Solution of	Salt.	Osmotic pressure (atmospheres).	Water absorbed by wheat.											
			12 hours.	24 hours.	36 hours.	48 hours.	60 hours.	72 hours.	84 hours.	96 hours.	108 hours.	120 hours.	132 hours.	144 hours.
	P. ct.		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Pure water	0	0	33.1	42.6	49.2	51.6	54.6	55.7	58.3	60.1	60.1	61.7	62.3	62.3
Sugar	1.43	1	33.4	43.2	49.3	51.3	54.3	55.2	58.2	59.8	60.8	61.4	62.0	61.7
Magnesium sulphate	.34	1	31.4	40.1	46.3	49.3	52.1	54.7	56.7	57.7	59.6	60.6	60.8	60.2
Sodium sulphate	.24	1	32.1	41.6	47.8	48.8	53.2	54.4	57.7	58.3	60.1	61.9	61.7	60.7
Sodium chlorid	.12	1	34.0	41.9	49.5	50.0	51.8	53.7	56.9	57.9	58.3	59.1	59.3	60.3
Sugar	14.30	10	26.3	27.9	41.8	44.2	45.0	46.0	46.7	47.8	48.1	48.1	48.1	47.9
Magnesium sulphate	3.94	10	31.2	38.4	43.3	45.5	45.9	46.9	47.9	48.9	48.9	48.9	48.7	48.7
Sodium sulphate	2.66	10	29.7	38.3	43.6	44.0	45.1	45.9	46.3	47.9	48.3	48.6	48.3	49.2
Sodium chlorid	1.39	10	31.5	39.7	44.3	44.9	46.6	47.0	47.2	47.2	47.6	47.4	48.2	50.0

"It will be seen from the table that the wheat absorbed just about the same amount of water from each of these in the same length of time. . . .

"Beans absorb the same amount of water when put into a saturated solution of common salt as they do when put into pure water. The dissolved salt apparently passes into the bean as readily as the water and destroys its power of germination. Rye is intermediate between wheat and beans in this respect.

"To decide the question whether the absorption of water is physical or physiological, comparative tests were made between living seeds and seeds in which the power of germination had been destroyed by age, heat, or exposure to formaldehyde vapor. No difference between the living and dead seeds has been yet observed, so it appears that water is drawn into the seed purely by such physical forces as surface tension and osmotic pressure. It does not appear that the salts mentioned, except sodium carbonate, exert any poisonous influence on the wheat. It germinates readily when removed from the alkali solutions and put under favorable conditions."

In continuation of work reported in Bulletin 29 of the station (E. S. R., 8, p. 568), the following experiments were made:

"Seeds of wheat and rye were germinated in pure water and in solutions of sodium carbonate (black alkali), sodium chlorid (common salt), sulphate of sodium

(Glauber's salt), sulphate of magnesia (Epsom salt), and in sugar sirups of the same strengths as the salt solutions used. Each of the salts used and the sugar were applied to the seeds in strengths of 0.1 per cent, 0.4 per cent, 0.7 per cent, 1, 2, 3, 4, 5, 7, and 9 per cent solutions. The sugar was used to throw light upon a technical point."

From the results of these experiments the following table, showing the amount of salts which may be present without retarding the germination of wheat and rye seeds, has been prepared:

Amounts of different salts which may be present without retarding germination of wheat and rye.

	Magnesium sulphate.		Sodium sulphate.		Sodium chlorid.		Sodium carbonate.	
	In solution.	In soil.	In solution.	In soil.	In solution.	In soil.	In solution.	In soil.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Wheat	1.0	0.25	0.7	0.17	0.4	0.1	0.4	0.10
Rye	1.0	.25	.7	.17	.4	.1	.1	.02

"The salts are injurious in the order they are given in this table. The black alkali (sodium carbonate) is much more injurious than the other salts, because it has a corroding effect due to the fact that it is not a neutral salt, and free acid is present to produce a share of the damage. Of the salts composing the common white alkali magnesium sulphate seems to be the least injurious, while common salt (sodium chlorid) is most injurious. . . .

"It has been found that fewer seeds will live, and it takes longer for them to germinate as the strength of the solution increases, and there is a marked difference between the different salts. . . .

"Eighty-eight per cent of the seeds of wheat germinated in water. In 3 per cent solutions of the salts, amounting to nearly 0.75 per cent of salt in the soil, the following percentage of the wheat was germinated: Magnesium sulphate 86 per cent, sodium sulphate 70 per cent, sodium chlorid 35 per cent, and sodium carbonate 14 per cent. Ninety-six per cent of the rye germinated in water. In 3 per cent solutions of the salts the following percentage of rye germinated: Magnesium sulphate 92 per cent, sodium sulphate 56 per cent, sodium chlorid 38 per cent, and sodium carbonate 22 per cent. This would indicate that rye will stand stronger alkali than will wheat, which corresponds with results of previous tests. . . .

"In these experiments it has been a most notable fact that small amounts of alkali salts were beneficial or at least that they accelerated instead of retarded germination. No doubt small amounts present in the soil also assist in the life of the plant, either stimulating its growth or acting directly as plant food."

An extensive series of pot experiments with alkali were made. While these experiments were not conclusive as to the effect of alkali on plant growth, they gave interesting data regarding the evaporation of water from soils containing different amounts of soluble salts. "From the pots containing no alkali 17.7 cc. was evaporated each day, while the amount of water lost from those pots containing 9 per cent solutions (equivalent to 2.2 per cent alkali in soil with 24.5 per cent moisture) was approximately one-half as much."

Plants which have shown alkali-resisting properties are briefly discussed. Those noted include saltbushes, English rape, Bokhara clover, and sugar beets.

The alkali of the Yellowstone Valley, M. WHITNEY and T. H. MEANS (*U. S. Dept. Agr., Division of Soils Bul. 14, pp. 39, pls. 17, figs. 3*).—This is an account of a preliminary study of the rise of alkali in

irrigated lands in the immediate vicinity of Billings, Montana. The Yellowstone Valley at this point is about 6 miles wide and bordered on either side by high bluffs—on the north the bluff is of sandstone and on the south of blue shale. The sandstone is a gray siliceous stone containing small but perceptible amounts of magnesium and sodium sulphates, which are either dissolved and carried away by the water which percolates through the rocks or accumulate in layers throughout the rocks. Where evaporation has gone on for some time these salts appear as white efflorescences on the surface.

"Underlying the sandstone and coming out from under the sandstone bluff there is a fine blue shale or slate which extends to an unknown depth. In an attempt to get artesian water at Billings a well was driven 900 ft. through this shale. No deeper record than this has ever been made at this place. The shale rises up from beneath the sandstone and forms the rough angular blue hills on the south side of the valley.

"The shale is penetrated with numerous fine cracks and joints running in all directions, and these are filled with fibrous gypsum. Many cavities also are found filled with gypsum and calcium carbonate. Everywhere throughout the shale large quantities of sodium and magnesium sulphates are found, which appear as white efflorescence where evaporation has taken place. . . .

"As the rocks weather, a portion of the soluble salts is removed in the springs and seepage waters, but the removal is not nearly so complete as is the case in the humid portions of the United States, because the small rainfall renders the escape of all of the excessive amounts of salts impossible.

"The two types of rock give rise to two distinct types of soil in the valley—one a sandy soil, derived from the disintegration of the sandstone rock, giving a soil of open texture, easily worked, in which there is less trouble from alkali on account of the more perfect drainage and less risk of the accumulation of seepage waters; the other type is a stiff clay or gumbo formed from the disintegration of the shales. These shale soils are extremely fertile when in good condition, but are quite difficult to work. They are easily puddled and are rendered almost impervious to water by the excess of the soluble salts which they usually contain, and it is upon these soils, with their poor underdrainage, that the greatest amount of trouble has arisen from the accumulation of seepage waters and salts in the overirrigation of the soils in the valley.

"Between these two extremes of sandy soil and gumbo, in areas where the layer of sandstone has not been completely removed, the soils are blended in all possible combinations, from the pure type of the sandy soil to that of the gumbo.

"The following table gives the mechanical analyses of a number of soils from Billings, which indicate the difference in the texture of the soils which has been noticed:

Mechanical analyses of soils near Billings, Montana.

Locality. (Miles from Billings.)	Description.	Moisture in air-dry sample.	Organic matter.	Gravel. (2 to 1 mm.)	Coarse sand. (1 to 0.5 mm.)	Medium sand. (0.5 to 0.25 mm.)	Fine sand. (0.25 to 0.1 mm.)	Very fine sand. (0.1 to 0.05 mm.)	Silt. (0.05 to 0.01 mm.)	Fine silt. (0.01 to 0.005 mm.)	Clay. (0.005 to 0.0001 mm.)
		P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
2½ N	Sandstone bluff soil	1.22	2.66	0.00	0.00	0.17	29.39	52.34	3.29	0.88	9.65
11 W	Silty type, creek soil	2.98	4.40	.00	.09	.16	7.96	28.79	34.45	4.67	17.25
5½ W	Sandy gumbo	1.56	4.66	.00	.00	.20	11.72	45.05	14.69	3.49	19.90
5⅓ W	do	1.94	3.30	.00	.10	.46	15.61	39.59	14.63	3.38	21.30
5½ W	do	2.35	3.72	.00	.02	.32	21.37	38.27	8.99	3.13	22.55
3 W	Gumbo	3.20	3.30	.01	.40	1.58	20.40	27.67	11.71	4.02	27.30
5 W	Heavy gumbo	3.74	4.22	.04	.03	.19	11.65	24.03	15.13	4.40	35.55

"The first sample is a very pure type of sandstone soil taken from the top of the bluff about 2½ miles north of Billings and was derived from the decomposition of the soft layers of fine sandstone which cap the bluffs. These soils are very light and loose and have very free underdrainage. As a matter of fact, they leach readily, and, although they afford the best possible conditions for irrigation in that seepage waters are not likely to accumulate in them, it is probable that they would not last very long, as the soluble salts would easily and quickly be removed from them. Soils of this type are found in many parts of the valley, and there is little or no danger from seepage waters or from an accumulation of soluble salts at the surface, although they contain considerable quantities of such salts at depths below the surface.

"The other samples in the table are seen to grade up through the mixed sandy gumbo to the pure form of gumbo with from 27 to 35 per cent of clay. The mixed soils are the most abundant in the valley."

When this valley was first settled, there were no signs of alkali on the surface of the soil, but now, after 12 to 15 years of irrigation (usually excessive) many once fertile tracts on the lower levels have become flooded, "and alkali has accumulated on them to such an extent that they are mere bogs and swamps and alkali flats."

The alkali in this locality, as indicated above, consists mainly of magnesium and sodium sulphates, with no sodium carbonate and but a trace of sodium chlorid. Its composition, which is very constant throughout the region, is shown by the following average of 5 analyses by F. W. Traphagen:

Composition of the soluble salts at Billings, Montana.

	Per cent.
Sodium sulphate	57.44
Magnesium sulphate	27.59
Calcium sulphate	13.05
Potash sulphate	1.55
Silica	.33
	99.99

In order to determine the amount and distribution of the soluble salts in the different soils, both with and without irrigation—

"Three lines of borings were run—one of 5 miles in length and the others, for more detailed study, of about 1½ miles and one-fourth of a mile, respectively, in length. The longer section began above the ditch and went down toward the river; the others extended from an alkali flat and from a drainage ditch back into the higher levels. In each of these sections a number of borings were made and the salt content determined at every foot in depth down to 10 or, frequently, 15 ft. In addition to this, a section or square mile of land was studied in great detail and borings were made at frequent intervals to a depth of 10 or 15 ft. A number of special borings were also made to study the relation of the different types of soil to the amount and distribution of the salts."

The amount of soluble salts present was determined by means of the electrical apparatus devised by the Division of Soils (E. S. R., 9, p. 535; 10, p. 30). The results are given in tables and in a series of charts and maps. The latter show graphically the depth to standing water and the amount and distribution of soluble salts at different depths in the soil of the area examined. "As a result of the investigations at Billings it

was found that plants could just exist with 0.45 per cent of the soluble salts present, equivalent to about 15,000 lbs. per acre-foot, and this is taken as the limit of plant production" in the preparation of these charts and maps.

"The results of these investigations show that the ultimate source of the alkali is in the sandstone, and particularly in the shale or slate rocks from which the soils have been derived. Before irrigation was introduced the salts were present in rather large amounts, but well distributed throughout the soil, and not in such large quantities as to be injurious to crops. The injury is due entirely to overirrigation, to the translocation and local accumulation of salts by means of seepage waters, and to the imperfect drainage facilities in the compact gumbo soils and the inability of the soils to remove the excess of salts and of seepage waters. . . . The open sandy lands, having better underdrainage, are not likely to be injured by a rise of salts except from an excessive application of water or in the low places in the path of the drainage system, especially when these are underlaid, as they are liable to be, by the heavy gumbo subsoils. . . . The investigations show, further, the very disturbing fact that the injury need not be due to a local application of water, but to the injudicious application of large quantities of it in remote localities and on neighboring farms. . . .

"The investigations point clearly to . . . the necessity of great care in the application of water in the methods of irrigation. This care must be exercised not only for the land which is being irrigated, but for the adjoining lands on lower levels. . . .

"Where the damage has been done, or where the conditions are so imminent that ultimate ruin can be foreseen, the logical method of reclamation is in providing adequate systems of drainage to carry off the excess of water and the accumulated salts. . . . It may be too soon yet to urge an extensive system of underdrainage in the valley, but some small systems should certainly be introduced, if necessary by cooperation, for an object lesson when it is considered necessary and timely to protect against trouble or to reclaim lands already abandoned. . . .

"It must not be assumed, however, that a thorough system of underdrainage relieves one from exercising care and judgment in applying water to the land. There is less immediate danger of ruining the land, to be sure, but there are two things to be considered, namely, that an excessive use of water means just so much loss to irrigation and so much less land which can be brought under the ditch, and also that in the removal of these salts by the flow of the seepage waters out through the drainage system large quantities of really valuable plant food are likely to be removed from the soil. . . . By overirrigation and underdrainage we may remove in a few years the very conditions which contribute to the wealth of the country in the fertility of the soil.

"In taking up new land in the Yellowstone Valley the heavy gumbo soils should be underdrained at the time the first irrigation waters are applied to the land. . . . It is too late to wait until the damage has been done, for the accumulation of salts themselves acts on the heavy gumbo soils and makes them more impervious to water and harder subsequently to drain. Great care must be taken in the application of water. . . .

"The rise in the level of water in wells must be looked upon with uneasiness and guarded against with great care."

The advisability of cultivating such alkali-resisting crops as are known, or of finding or breeding others, is discussed, but it is considered unfortunate "for a locality like the Yellowstone Valley, which is originally free from alkali, to accept such conditions resulting from their injudicious methods of irrigation and try to find crops which will thrive upon lands which have been unnecessarily injured."

The causes of injury to plants by alkali are explained. "Field work in the alkali soils at Billings has shown that when the concentration of the salts in active solution in the soil moisture is as high as 1 per cent the limit of most cultivated plants is reached." The injury is due to the fact that when "the concentration of the soil solutions becomes greater than a 1 per cent solution the osmotic pressure of the solution outside of the cell is greater than the pressure of the solution inside the cell and the cell is unable to absorb water." (See also abstract of Wyoming Station Bulletin 39, p. 1025.)

"It has been found that the solid grains of soil have the remarkable power of absorbing or concentrating a portion of the salts on their surface and thus withdrawing them from active solution. This is of the greatest practical importance, as otherwise the soil moisture would quickly become saturated with salts and rendered totally unfit for agricultural plants. As a matter of fact, in consequence of this condensing power, in no case was the concentration of the soil moisture found to exceed 3 per cent, although the salts were quite soluble and were crystallized out on the surface of the ground."

Soil temperatures, L. G. CARPENTER ET AL. (*Colorado Sta. Bul. 49, pp. 55–63, fig. 1*).—The weekly averages of soil temperatures (recorded by two sets of thermometers) down to depths of 6 ft. are reported, and the effect of irrigation on the temperature of the soil is discussed.

"[One set of soil thermometers was so situated in a grass plat] that the irrigation of the lawn flooded to a depth of some inches the ground where the instruments were placed, and the irrigation was continued long enough to saturate the ground underneath.

"The temperature at a depth of 6 ft. had been nearly uniform at 62° for a number of weeks before the date of irrigation on August 12.

"With the application of water it is noticed that the temperature immediately rises, reaching a temperature of 71° almost immediately after. The temperature fell almost immediately after the irrigation, so that during the next 3 days it had fallen to 64.5°. On August 16 the irrigation was repeated, and this time the effect of this, added to the effect of the first, was to increase the temperature to 75.5°. The temperature dropped rapidly to 69°, and then dropped gradually, not again reaching 62° until October. The effect of irrigation on the plat of ground and its vicinity was felt for more than a month.

"The effect on the temperature at 2 ft. and at 3 ft. in depth was much the same. At the first irrigation the temperature at 2 ft. was increased over that at the lower depths. At the second irrigation the effect on the deep thermometers was almost as great as upon the 2-ft. thermometer.

"For the depths less than 2 ft. the diurnal fluctuation is marked. . . . The shallower thermometers also show the cooling effect from evaporation so much that their temperatures fell below the deeper ones."

The air and the methods of hygrometry, A. and H. WOLPERT (*Die Luft und die Methoden der Hygrometrie. Berlin: W. & S. Loewenthal, 1899, pp. XXII+388, figs. 108*).

The maximum amount of chlorids in sea air, A. GAUTIER (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 12, pp. 715, 716*).—The author found in the air of the Atlantic Ocean 0.00462 gm. of chlorin, corresponding to 0.022 gm. of sodium chlorid per cubic meter of air.

The absence of iodin in the free state or in the form of iodated gas in the air of the region of Toulouse, F. GARRIGOU (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 14, pp. 884, 885*).

Researches on moorland waters: I, Acidity, W. ACKROYD (*Jour. Chem. Soc. [London], 75 (1899), No. 436, pp. 196–200, fig. 1*).—An account of studies especially with reference to the fitness of such waters for drinking purposes.

A new chemical process for the purification of water to be used for irrigation, G. TRUFFAUT (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), Feb., pp. 184–190*).—From the hardness, as determined with standard soap solution, the amount of monopotassium phosphate required to remove the larger part of the calcium and magnesium and convert the harmful salts into useful forms is calculated.

On methods of determining the fertilizer requirements of cultivated soils, O. KELLNER (*Mitt. Oekon. Gesell. Sachsen, 1897–98, II, pp. 16*).—A general discussion of this subject.

Directions for judging the agricultural value of soils, K. BIELER (*Menzel u. von Lengerke's Landw. Kalender, 1899, pt. 2, pp. 53–80, figs. 2*).—A popular discussion of the value of mechanical and chemical examination both of the surface and subsoil as means of determining the agricultural value of soils.

Soils and fertilizers, C. M. BLACKFORD (*Pop. Sci. Mo., 54 (1899), No. 3, pp. 392–401*).

Analyses of the arable soils of Belgium, A. PETERMANN (*Rev. Gén. Agron., 8 (1899), No. 2, pp. 49–55; 3, pp. 113–120*).

Soil analyses at Wollongbar, H. V. JACKSON (*Agr. Gaz. New South Wales, 10 (1899), No. 2, pp. 166–168, fig. 1*).—Analyses by F. B. Guthrie of samples from fertile and infertile spots of a deep, friable, well-drained red loam showed the infertile spots to be acid.

The nitrogenous compounds which accompany humus acids in soils and peat, F. SESTINI (*Landw. Vers. Stat., 51 (1899), No. 2–3, pp. 153–158*).—See E. S. R., 10, p. 424.

Soil temperatures (*New York State Sta. Rpt. 1897, pp. 628–634*).—A tabulated summary of tridaily observations during 1897 at depths of from 1 to 18 in.

FERTILIZERS.

Analyses and valuations of fertilizers, L. A. VOORHEES and J. P. STREET (*New Jersey Stas. Bul. 132, pp. 61*).—This bulletin gives trade values of fertilizing constituents in 1898 and the results of examinations of the standard commercial materials supplying them, as well as of home mixtures, factory-mixed fertilizers, and miscellaneous fertilizing materials. Analyses and valuations are given of 85 samples of standard raw materials, 305 brands of complete fertilizers, 28 samples of ground bone, 23 samples of home and special mixtures, and 38 samples of miscellaneous products. The materials examined include, in addition to the mixed fertilizers, nitrate of soda, sulphate of ammonia, dried blood, ground fish, tankage, ground bone, superphosphates, muriate of potash, sulphate of potash, kainit, double phosphate of potash and magnesia, saltpeter lime, lime from soft clam shells, shell marl, a lime fertilizer, wood ashes, crematory ashes, wool waste, bat guano from Mexico, cotton-seed meal, and pigeon manure.

The consumption of fertilizers in the State in 1897 was practically the same as in 1896. The 305 brands of fertilizers examined were the product of 81 manufactories, indicating a tendency to excessive multiplication of brands. The fertilizers examined furnished on an average the amount of plant food guaranteed, but in only 66 per cent of them was it distributed in the proportion stated. The average composition, estimated value, and selling price of all brands of complete fertilizers

examined during the year were as follows: Total nitrogen, 2.45; total phosphoric acid, 10.69; available phosphoric acid, 8.37; insoluble phosphoric acid, 2.32; potash, 5.38 per cent; station valuation, $19.90; selling price, $28.58; actual difference, $8.68; percentage difference, 43.6 per cent. A comparison of these figures with similar data for previous years (E. S. R., 9, p. 935) shows that the composition of the average fertilizer has been remarkably uniform for the past 8 years.

The average cost per pound of nitrogen in the samples (12) of nitrate of soda examined was 12.33 cts.; of sulphate of ammonia (1 sample), 14.02 cts.; dried blood (9 samples), 11.52 cts.; ground fish (9 samples), 11.54 cts.; and ground bone (15 samples), fine, 11.19, and coarse, 8.29 cts. The average cost per pound of available phosphoric acid in plain superphosphate (15 analyses) was 3.34 cts. The average cost per pound of potash in muriate of potash (12 samples) was 3.82 cts.; in kainit (3 samples), 4.04 cts.

Virginia marls, W. B. Ellett and A. T. Eskridge (*Virginia Sta. Bul. 78, pp. 65-70*).—This bulletin reports analyses of 36 samples of marl from different parts of Virginia, accompanied by a brief review of the history of the use of marls in Virginia and a discussion of their value as a fertilizer. The analyses are grouped in three classes: (1) Marls containing upward of 20 per cent of lime (19 samples), (2) marls containing over 1 per cent of phosphoric acid (12 samples), and (3) marls containing over 1 per cent of phosphoric acid (5 samples). "The analyses make it clear that there are marls of high fertilizing value to be found in some sections of the State."

Investigations on the fertilizing value of carbon bisulphid, E. Wollny (*Vrtljschr. Bayer. Landw. Rath., 1898, No. 3, pp. 319-312*).—This is an account of experiments in pots and in the field with a variety of crops, extending over several years and designed to test not only the direct, but the after-effect of carbon bisulphid. Two series of experiments were made; one in which the bisulphid was applied during the growing period of the plants and the other in which the bisulphid was applied some months before the planting of the crops. The results showed that in the former case the plants were either killed or their growth checked and the yield reduced, while in the latter case the yield was considerably increased. However, the yields the second or third year, if no fertilizer was applied, were smaller on those soils which had received the carbon bisulphid the previous year than on those which had not received an application of this substance. The causes of the peculiar action of the bisulphid were not explained by these experiments. The activity of the nitrifying organisms of the soils and of the organisms of the root tubercles of leguminous plants was checked, but the organisms were not killed even by the use of considerable quantities of bisulphid. The crops experimented with were beans, peas, carrots, beets, potatoes, rye, maize, mixed grasses, flax, clover, alfalfa, camelina, and rape. In the pot experiments 10 cc. of carbon bisulphid was used in each pot (containing 4.15 kg. of soil).

In the field experiments plats 4 square meters in area were used. In each plat 16 holes were made at regular intervals to depths of from 30 to 50 cm. and 25 cc. of carbon bisulphid applied in each hole.

Experiments to determine the fertilizer requirements of soils, G. LIEBSCHER ET AL. (*Jour. Landw., 46 (1898), No. 4, pp. 319–412*).—This is an account of a continuation by Edler, Kretschmer, von Seelhorst, and J. Wilms of experiments planned by G. Liebscher (E. S. R., 7, p. 664) to determine the fertilizer requirements of soils by means of field and pot tests, the latter accompanied by analyses of the soils and plants.

The results of field experiments with fertilizers in a number of different localities in 1895 were inconclusive, it being impossible to determine whether the differences observed were due to the fertilizers used or to variations in the other conditions. When, however, tests were made with the different soils in pots accompanied by a study of the composition of the soil and of the crop produced, more definite results were obtained. It was found in this case that, under like conditions of culture, heat, moisture, etc., plant analysis furnished a reliable means of judging of the fertilizer requirements of the soil. It is considered more reliable for this purpose than soil analysis, although the latter furnishes useful data. The conditions in pot experiments vary so widely from those which obtain in the field that, in the authors' opinion, there is a question whether the composition of the plants grown in the field would not differ materially from that of plants grown in pots. It was found in many cases that the potash content of the crop was increased by applications of phosphoric acid, although the opposite was rarely true. The results further show that a constituent which was in relative excess in the soil was also found in excess in the crop.

Barnyard manure, F. T. SHUTT (*Canada Cent. Expt. Farm Bul. 31, pp. 20, pl. 1*).—This is a popular article on the nature, functions, composition, fermentations, preservation, and application of barnyard manure based to a large extent on investigations made by the author and his associates.

Report of analyses of commercial fertilizers for the fall of 1898, L. L. VAN SLYKE (*New York State Sta. Bul. 148, pp. 199–225*).—The results of analyses of 162 different brands of fertilizers are reported and the composition and quality of the different fertilizers offered for sale in the State during the year 1898 are discussed. Of the 162 brands examined, 111 were complete fertilizers. In these the nitrogen varied from 0.46 to 4.69 per cent, averaging 1.67 per cent; the available phosphoric acid varied from 4.77 to 13.45 per cent, averaging 9.27 per cent; the potash varied from 0 36 to 10.43 per cent, averaging 4.36 per cent. The average amounts of nitrogen, available phosphoric acid, and potash exceeded the guaranteed average by 0.16, 0.96, and 0.26 per cent, respectively.

Analyses of fertilizers, C. A. GOESSMANN (*Massachusetts Hatch. Sta. Bul. 57, pp. 24*).—The bulletin contains analyses of 57 samples of fertilizing materials sent to the station for examination and 127 brands of commercial fertilizers collected during 1898. The fertilizing materials analyzed include wood ashes, limekiln ashes, peach-twig ashes, potatoes, clover hay, tobacco stems, hop refuse, dried blood, peat, sulphate of ammonia, sulphate of potash and magnesia, tankage, bone meal, barnyard manure, sewage, and complete fertilizers. A schedule of trade values for 1898 is given.

The Peruvian guano deposits from 1878 to 1898, J. H. M. FALLON (*Jour. Soc. Chem. Ind., 18 (1899), No. 3, pp. 213–224, figs. 4*).—A brief history of these deposits.

Analyses of bat guano, F. WATTS (*Jour. Jamaica Agr. Soc., 3 (1899), No. 3, p. 153*).—Analyses of samples of medium and rich quality, representative of deposits on the island of Jamaica.

The potash industry, H. PASSMANN (*Die Kaliindustrie in ihrer Bedeutung und Entwickelung. 2 ed. Stassfurt, 1899, pp. III+120*).

Phosphatic nodules of Trichinopoly and the use of mineral phosphates in agriculture, D. HOOPER (*Agr. Ledger, 1898, No. 20 (Agr. ser., No. 28), pp. 10*).—These nodules, which are found scattered over the surface or distributed through the soil in more or less abundance over a considerable area in this district, showed on analysis 53 to 60 per cent of tricalcium phosphate, 4 to 8 per cent of oxid of iron and alumina, and 12 to 23 per cent of calcium carbonate.

The value of the lime in phosphatic fertilizers, MAIZIÈRES (*L'Engrais, 14 (1899,) No. 8, pp. 179–181*).—A discussion, based largely upon the work of Ullmann, of the fertilizing value of the free lime of Thomas slag and the gypsum of superphosphates.

Remarks on the determination of the fertilizer requirements of soils, C. VON SEELHORST (*Jour. Landw., 47 (1899), No. 1, pp. 91–94*).—An explanation of some of the details of the experiments reported in the article noted above (p. 1033).

Fertilizers for natural meadows (*L'Engrais, 13 (1898), No. 41, pp. 977, 978*).—A summary of the results of investigations on this subject, with conclusions.

FIELD CROPS.

Results obtained in 1898 from trial plats of grain, fodder corn, and roots, W. SAUNDERS (*Canada Cent. Expt. Farm Bul. 32, pp. 47, figs. 2*).—These tests were in continuation of cooperative work previously reported (E. S. R., 9, p. 826). The general plan of the experiments remained unchanged. The results are given in tabular form.

Taking the average results obtained on all the experimental farms the varieties of the different crops producing the largest yield in 1898, mentioned in their order, were as follows:

Oats.—Bavarian, Banner, White Giant, Oderbruch, Columbus, American Triumph, American Beauty, California Prolific Black, Abundance, White Schonen, Mennonite, and Golden Beauty. *Two-rowed barley.*—Beaver, Dunham, Danish Chevalier, Newton, French Chevalier, and Prize Prolific. *Six-rowed barley.*—Pioneer, Stella, Odessa, Mensury, Oderbruch, and Trooper. *Spring wheat.*—Wellman Fife, Monarch, White Connell, Goose, White Fife, Red Fife, Preston, Progress, Percy, Rio Grande, Stanley, and Emporium. *Peas.*—Perth, Pride, Elephant Blue, King, Harrison Glory, Trilby, Vincent, Early Britain, Picton, New Potter, German White, and Bruce. *Corn.*—Red Cob Ensilage, Giant Prolific Ensilage, Thoroughbred White Flint, Early Mastodon, Champion White Pearl, and Cloud Early Yellow. *Turnips.*—Purple-top Swede, Jumbo, Giant King, Sutton Champion, Hall Westbury, and Perfection Swede. *Mangel-wurzels.*—Yellow Intermediate, Gate Post, Giant Yellow Globe, Canada Giant, Giant Yellow Intermediate, and Norbiton Giant. *Carrots.*—Mammoth White Intermediate, Improved Short White, Half Long White, White Belgian, Green Top White Orthe, and Giant White Vosges. *Sugar beets.*—Danish Red Top, Danish Improved, Red Top Sugar, and Improved Imperial. *Potatoes.*—American Giant, Seedling No. 7, Date Puritan, New Variety No. 1, American Wonder, Irish Daisy, Dreer Standard, Clay Rose, Green Mountain, State of Maine, Polaris, and Rural Blush.

The average yields per acre in 1898 of the varieties here mentioned were approximately as follows: 69 bu. of oats, 42 bu. of two-rowed bar-

ley, 47 bu. of six-rowed barley, 30 bu. of spring wheat, 40 bu. of peas, 22 tons of silage corn, 33 tons of turnips, 33 tons of mangel-wurzels, 25 tons of carrots, 24 tons of sugar beets, and 453 bu. of potatoes.

The varieties of different crops which have given the best average yields at the several experimental farms during the past 4 years, in the order of their productiveness, are as follows:

Oats.—Banner, American Beauty, Columbus, Golden Beauty, Bavarian, Holstein Prolific, White Schonen, Early Golden Prolific, Wallis, Abundance, Golden Giant, and White Russian. *Two-rowed barley.*—French Chevalier, Danish Chevalier, Beaver, Canadian Thorpe, Newton, and Prize Prolific. *Six-rowed barley.*—Mensury, Odessa, Trooper, Common, Royal, and Oderbruch. *Spring wheat.*—Preston, Wellman Fife, Monarch, Percy, Red Fife, White Fife, White Connell, Rio Grande, Goose, Red Fern, Old Red River, and Advance. *Potatoes.*—Irish Daisy, Seedling 230, Late Puritan, American Wonder, Reading Giant, New Variety No. 1, Lee Favorite, Empire State, State of Maine, McKenzie, Clark No. 1, and Queen of the Valley.

The approximate average yields of these varieties of oats, two-rowed barley, six-rowed barley, spring wheat, and potatoes was 67, 34, 46, 29, and 343 bu. per acre respectively.

The varieties of peas, mangel-wurzels, and carrots giving the best average yields for 3 years at all the experimental farms were as follows:

Peas.—Crown, Carleton, Pride, New Potter, Prince Albert, Arthur, Centennial, Paragon, Creeper, Trilby, Duke, and Kent. *Mangel-wurzels.*—Gate Post, Giant Yellow Intermediate, Yellow Intermediate, Giant Yellow Globe, Mammoth Long Red, and Canada Giant. *Carrots.*—Improved Short White, Half Long White, Giant White Vosges, Mammoth White Intermediate, Iverson, Champion, and White Belgian.

The approximate average yields of these varieties of peas, mangel-wurzels, and carrots were 34 bu., 30 tons, and 18 tons per acre respectively.

The effect of different methods of culture on the yield of mangel-wurzels, E. Wollny (*Bl. Zuckerrübenbau, 5 (1898), No. 15, pp. 225–232; 16, pp. 241–248*).—Ridge and level culture were compared, and a method, which consisted in making broad and flat-topped ridges along the middle of which the seed was planted and then level cultivation given, was tried. The data obtained show that the temperature of the ridged soil was higher and subject to greater variations than the soil which was given level cultivation; that the ridged surface had the smaller water content; and that the effect of drought is most marked on soils of a comparatively small water-holding capacity. It was found that ridges running north and south had a higher and less variable temperature than ridges extending east and west. The author concludes that ridge culture and growing plants on broad and flat ridges is advisable only on soils with large water-holding capacity and in moist climates. The general conclusion is that growing beets on broad and flat-topped ridges with level cultivation in a mild and moist climate and on soils of medium to large water-holding capacity is preferable to the ordinary ridge culture.

A report of the cultural experiments at the agricultural college at Carlsburg (*Bul. Agr.* [*Brussels*], *14* (*1898*), *No. 6*, *pp. 612–619*, *pl. 1*).—The results of fertilizer and cultural experiments with oats and potatoes carried on for 13 years are tabulated, and the results obtained during the season of 1898 are discussed in detail. The fertilizers applied were barnyard manure, a complete commercial fertilizer, a fertilizer which furnishes nitrogen only, and fertilizer mixtures in which either nitrogen, phosphoric acid, potash, or lime was lacking. In general, barnyard manure gave the best results.

Harrowing meadows proved effective in the destruction of weeds. Spraying a weedy field of oats with a solution of a mixture of copper sulphate and ferrous sulphate (7½ kg. per hectoliter of water) resulted in the destruction of the weeds without a bad effect on the oats or the clover which grew under it.

Distance experiments with sugar beets and fertilizer tests with potatoes, C. von Seelhorst (*Fühling's Landw. Ztg.*, *47* (*1898*), *No. 8*, *pp. 300–302*).—Better results were obtained when beets were planted 20 cm. apart in rows 20 cm. apart than when either of the distances was 30 or 40 cm. The fertilizer experiment with potatoes showed that kainit, carnallit, and muriate of potash, when applied late, decrease the starch content of the tubers, while sulphate of potash and carbonate of potash and magnesium increased the starch content. Muriate of potash, sulphate of potash, and carbonate of potash and magnesium were the most effective in increasing the total yield.

The composition of sugar beets rich in sugar (*Chem. Ztg.*, *22* (*1898*), *No. 98*, *p. 1035*).—In 1898 1,200 samples of sugar beets analyzed in the State Laboratory at Löwen, Belgium, showed an average sugar content of 16.4 per cent. From a comparison of the composition of rich sugar beets it is concluded that the percentages of nitrogenous and mineral substances and cellulose decreases as the sugar content increases; further, that the sugar content of the beet increases as the percentage of lime in the beet increases and the percentages of potash and phosphoric acid decrease and that the content of magnesia remains relatively the same.

The influence of different rates of fertilization on the yields of cultivated plants, E. Wollny (*Bl. Zuckerrübenbau*, *5* (*1898*), *No. 4*, *pp. 369–373*).—From the results of growing sugar beets, mangel-wurzels and potatoes fertilized with different amounts of a mixture consisting of equal parts of superphosphate, chlorid of potash, and nitrate of soda, the author concludes that the yield increased with the increase of plant food up to a certain point, when the rate of increase in the yield began to diminish and finally reached a point beyond which the increase of plant food became unprofitable.

Report of field experiments, 1897–98, A. Damseaux (*Bul. Agr.* [*Brussels*], *14* (*1898*), *No. 6*, *pp. 591–605*).—The results of fertilizer experiments with cereals and root and forage crops are reported. Among 13 varieties of wheat Carter D, Barbu jaune à épi carré, Standup, and Rivett Bearded, in the order given, were the most pro-

ductive. Two varieties of rye, Lochow and Baunet, and 1 variety of oats, La Précoce d'été Chrestensen, are recommended. A dressing of 400 kg. per hectare of superphosphate produced a larger increase in the yield of oats than a dressing of 200 kg. per hectare of nitrate of soda, and when these applications were applied together the results were not as satisfactory as when they were applied separately. The use of Alinit seemed to have no effect on the yield of oats.

Eight varieties of sugar beets were grown, all of which showed a high sugar content and coefficient of purity and a good yield. The following varieties are mentioned as producing beets of good form: Rimpau à Schlanstedt, Keilholz améliorée, Selection Dumont-Brabant, and Baumeier Kleinwanzleben. Nitrate of soda and sulphate of ammonia were applied before the sugar beets were planted. The nitrate of soda increased the yield at the expense of sugar content and purity, while the sulphate of ammonia had no detrimental effect on the sugar content and purity, but produced a smaller increase in yield. Muriate of potash was found more effective than kainit.

The results of testing gypsum as a fertilizer for clover showed that the application should not be made as a top-dressing.

Tests were made of fertilizing and cultivating the sod of two-year-old meadows. Peruvian guano was applied at the rate of 350 kg. per hectare on February 21 and cultivation with a harrow was given to the depth of 6 cm. The fertilizer applied alone gave the best results, followed in their order by the use of the fertilizer together with cultivation, and cultivation alone.

Test of fertilizers on wheat, D. O. NOURSE (*Virginia Sta. Bul. 77, pp. 53–61*).—This is in continuation of work formerly reported, and the plan of the experiment has been described in a previous abstract (E. S. R., 9, p. 747). The results for the present year and the average results for 3 years are given in tables. The financial results of the different applications are discussed. The average results for the 3 years show that when applied alone potash was practically without effect, nitrogen increased the yield, but not enough to pay for the application, and phosphoric acid more than doubled the yield of grain and straw. The following table gives the results obtained when the fertilizers were applied together, each in amounts sufficient to supply either all the phosphoric acid or one-half of the potash or nitrogen removed in a crop of wheat of 25 bu. per acre.

Results of fertilizer tests with wheat.

Plant food.	Grain per acre.				Straw per acre.			
	1896.	1897.	1898.	Average.	1896.	1897.	1898.	Average.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
No fertilizers	5.22	5.90	7.72	6.28	676	590	1,041	769
Potash and nitrogen	5.83	9.61	11.37	8.94	1,060	873	1,178	1,037
Potash and phosphoric acid	13.00	16.36	19.50	16.29	1,570	1,277	1,780	1,512
Phosphoric acid and nitrogen	12.66	17.95	23.46	18.02	1,310	1,543	2,453	1,769
Potash, phosphoric acid, and nitrogen	18.04	19.43	27.00	21.49	1,718	1,574	2,680	1,991

A contribution to the question of how kainit affects the potato when applied to the preceding crop, O. LEMMERMANN (*Landw. Vers. Stat., 51 (1898), No. 2-3, pp. 159-184*).—A number of cooperative experiments were made with different amounts of kainit applied to the cereal crop which preceded a crop of potatoes. In every case 9 plats each 5 ares in size were used. In addition to uniform green manuring and an application of 1,000 kg. of lime per hectare, 3 received 1,000 kg. kainit per hectare, 3 received 2,000 kg., and 3 received no kainit. The fertilizers were applied in the fall of 1894. A cereal crop was grown the following season, and in 1896 a crop of potatoes. The results from the kainit applications on the cereal crop indicate that on soils containing 0.2351 per cent of potash a potash fertilizer for wheat and rye is recommendable, and that on soils containing 0.2424 per cent of potash an addition of potash is unnecessary for oats.

In general the application of kainit in these experiments acted beneficially, but the results from different amounts on the various soils were not parallel. In all cases except one, plats receiving kainit produced better yields than plats to which no kainit had been applied. The yield from the larger applications was greater in a number of cases than the yield from the smaller applications, but the increase was not in proportion to the amount applied. In a few instances the application of 2,000 kg. per hectare proved too heavy, and the yields were smaller than those obtained on plats which had received one-half that amount or no kainit. The action of kainit in these tests did not show any marked regularity, and the author considers further experiments necessary before definite conclusions can be drawn.

Researches on the quantities of fertilizing materials necessary in the intensive culture of the potato, A. GIRARD (*Ann. Sci. Agron., 1897, II, No. 2, pp. 261-280*).—Observations were made of the amount of plant food removed from the soil by the different parts of the potato plant. Eight different varieties were studied. It is concluded that the maximum yields of tubers of these varieties removed on an average 110.80 kg. of nitrogen, 25.31 kg. of phosphoric acid, and 183.35 kg. of potash per hectare.

On the consumption of water in rice fields, I. INAGAKI (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 407-414, pl. 1*).—This article gives a record of measurements at intervals of two or three days of transpiration from rice plants growing in pots. The experiments covered the period from January 18 to October 20. The pots were covered with an apparatus which maintained the water in the pot at a constant level, measuring the water so used and at the same time recording the evaporation from the surface of the pots as well as the excess of water which the plants received due to wind, rain, or diminution of atmospheric pressure. From the data obtained in these experiments it is estimated that the rice crop transpires 1.539 liters of water per hectare per second. In experiments in the field it was found

that the amount of water so utilized by the rice plant was 1.068 liters of water per hectare per second. It thus appears that the water requirements of rice are much smaller in Japan than in Italy, where, according to Patriarca,[1] the average amount of water required by rice is 2.637 liters per hectare per second. This difference is believed to be due to the greater humidity of the air in Japan (76 to 94 per cent, as compared with 52 to 69 per cent in Italy).

Report of the agricultural exposition of Kiev and the agricultural industries of Russia, H. Sagnier (*Bul. [Min. Agr. France], 17 (1898), No. 2, pp. 488–513*).—This report discusses the agricultural exposition held at Kiev in 1897 and the history and present condition of agricultural education in Russia, and gives descriptions of the Agronomic Institute at Moscow, the Imperial Agricultural Museum, and the Botanic Gardens at St. Petersburg. An outline is given of the systems of agricultural experiment stations and meteorological stations and the general work of the Ministry of Agriculture is pointed out.

November crop report, C. C. James (*Ontario Bureau Ind. Bul. 68, pp. 31*).—This bulletin gives the estimates of the yields of crops, statistics of live stock, and the total rainfall and average temperature for the Province of Ontario for 1898.

Some statistics of the world's production and consumption of cereals, L. Grandeau (*Ann. Sci. Agron., 1898, II, No. 2, pp. 127–228*).—Figures are given on the production of cereals in general, on the production of wheat for all countries, and on the cost of producing wheat in France.

The culture of beets for forage, E. Mer (*Prog. Agr. et Vit. (ed. L'est), 20 (1899), No. 13, pp. 399–401*).—This article reviews the methods of growing beets for forage in different parts of France and gives directions for their culture.

Broom corn (*Wallace's Farmer, 24 (1899), No. 14, p. 313*).—A popular note on the culture of broom corn in central Kansas.

Cost of cane culture, R. E. Rose (*Florida Agr., 26 (1899), No. 15, p. 227*).—A brief article on the cost of growing sugar cane in Florida and Louisiana.

The cultivation of pindars or ground nuts in Jamaica, F. Watts (*Jour. Jamaica Agr. Soc., 1898, No. 10, pp. 409–414; abs. in Jour. Soc. Chem. Ind., 17 (1898), No. 12, p. 1200*).

General observations on oats, Balland (*Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 16, pp. 579–581*).

Raising peanuts by irrigation (*Fla. Agr., 26 (1899), No. 15, pp. 26, 27*).—A brief article on the subject.

Some good varieties of potatoes (*Amer. Gard., 20 (1899), No. 226, p. 301*).—Notes on 16 of the newer varieties of potatoes tested at the Ohio Station the last two seasons.

The potato in France in 1781, G. Henslow (*Gard. Chron., 3. ser., 25 (1899), No. 639, p. 177*).—A review of a work on the potato published in France in 1781, containing many points of historical interest.

The influence of form, size, and starch content of seed potatoes on the yield, M. Fischer (*Fühling's Landw. Ztg., 48 (1899), No. 5, pp. 188–193; 6, pp. 201–208*).—Experiments were conducted to determine the influence of these factors on the yield of potatoes, and the results are here tabulated and discussed.

Relations between the color of the grain, its composition, and the form of the heads and stems of rye, N. Westermeier (*Fühling's Landw. Ztg., 47 (1898), No. 22, pp. 847–852*).—This article is a discussion of the results of breeding rye by different breeders. The author states that so long as it has not been proved that yellow-grained rye is the more productive, green-grained rye should receive the preference

[1] Compare Markus, Landw. Meliorationswesen, 1881, p. 59.

on account of its higher nitrogen content. A discussion of this subject has been previously noted (E. S. R., 10, p. 349).

The British millers' requirements in wheat (*Agr. Gaz. New South Wales, 9 (1898), No. 7, pp. 750-761*).—The article considers the wheat berry, the endosperm, and the germ, besides discussing the milling requirements in a general way.

Experiments in the improvement of fodder roots, C. V. GAROLA (*Ann. Sci. Agron., 1898, II, No. 3, pp. 423-479*).—Results are given of cultural experiments and investigations on the chemical composition and digestibility of fodder roots.

The chemical composition of maize and its products, H. W. WILEY (*Ann. Agron., 25 (1899), No. 1, pp. 33-47*).—This is a translation by E. Gain of U. S. Dept. Agr., Division of Chemistry Bul. 50 (E. S. R., 10, p. 624).

Legumes in their relation to crop rotations, SALFELD (*Deut. Landw. Presse, 26 (1899), No. 24, pp. 259, 260*).—A discussion on the value of various legumes in the rotation, with a statement of results obtained in practice.

HORTICULTURE.

The Stringfellow root-pruning theory, H. N. STARNES (*Georgia Sta. Bul. 40, pp. 147-179, pl. 1, figs. 25*).—The Stringfellow method of close root pruning is described and illustrated and the advantages claimed for it enumerated. They are, in short, a saving of time, labor, and consequent expense in handling, and a nearly perpendicular downward growth of the roots of the transplanted tree. In the first experiment one-year-old trees of Elberta peaches averaging 5 ft. in height were planted February 1, 1896, on red loam with a stiff red clay subsoil. There were 12 rows, each containing 21 trees, the rows being 18 ft. apart. The roots of the trees in the different rows were either unpruned, pruned only when broken, or pruned to 1, 2, or 4 in. clubs, or 1 or 4 in. taps, the tops in all cases being pruned to 18 in.; or the roots were pruned only where broken and the tops left unpruned or pruned to 12 or 24 in. At the same time in another location there were planted several small plats of apples and cherries, either unpruned or root-pruned to 1 in. clubs with tops pruned to 18 in. All trees with whole roots were planted in the usual manner in standard holes and the rootless ones in a crack made by inserting a spade perpendicularly in the ground and withdrawing it.

The season which followed was exceptionally dry, yet every tree lived and appeared to flourish. At first the trees having whole or nearly whole root systems appeared to make the most rapid growth, but by fall there was little difference observable except in the rows that had not been top-pruned. The trees in these rows were less symmetrical than others, and showed a distinct warp or inclination toward the north. Little difference, if any, was observable between the rows whose tops had been pruned to 12, 18, and 23 in., respectively, all branching equally low.

The following winter one tree from each row was dug up and the dirt carefully washed away, thus exposing the entire root system. All were found so uniform in size, habit of growth, and general characteristics

that a second test of one-year-old roots was made. In this fewer trees were used, and McIntosh was substituted for Elberta.

One tree from each row was dug up, the roots freed from dirt, and photographed.

The assertion that the new root system will penetrate almost perpendicularly downward is not supported by these experiments. It is possible, however, that in more sandy ground the roots would assume a more nearly perpendicular direction. In the second experiment the best growth, both aerial and underground, was found in the rows which had been pruned to 4-in. taps and 1-in. tap planted in dibble holes. Observations upon the roots of two years' growth in the first experiment are given in the following table:

Roots after two years' growth.

Treatment.	Average diameter of root system.		Weight.	Depth of root system.	Diameter of stem.
	Ft.	*In.*	*Pounds.*	*Inches.*	*Inches.*
1-inch club	8	0	5.93	19.0	$2\frac{1}{3}$
2-inch club	7	0	7.47	20.0	$2\frac{1}{3}$
4-inch tap	7	6	8.68	18.0	$2\frac{1}{2}$
4-inch club	8	0	10.66	15.5	$2\frac{7}{8}$
Pruned only where broken	10	1	14.30	17.5	$3\frac{1}{8}$
Roots unpruned	9	1	11.04	15.0	3
1-inch tap planted in dibble hole	10	10	8.04	20.5	$2\frac{1}{2}$
1-inch tap planted in normal hole	11	3	8.95	19.3	$2\frac{3}{4}$

In all cases the taps were pruned to 18 in. The best and finest root systems were found in the trees pruned to 1-in. tap and planted in dibble or normal hole. The weight and diameter of stem was less than in others, but the roots penetrated much deeper. The whole root system had more fibrous laterals.

The apples and cherries were examined at the end of the second season, and the difference between the unpruned and closely pruned roots was found much more pronounced. The latter made fewer, larger, and more robust roots, penetrating to a depth of $17\frac{1}{2}$ in. The former made a mass of small laterals, penetrating to only $9\frac{1}{2}$ in. The author is fairly satisfied that peach, apple, and cherry trees pruned by the Stringfellow method will live and flourish in his section of Georgia, even in stiff soil and under adverse meteorological conditions.

Orchard notes, F. S. EARLE (*Alabama College Sta. Bul. 98, pp. 263–277*).—Notes are given on the possibilities of successful apple culture in Alabama. An orchard of about 45 varieties was planted on the station grounds in 1885. Of these 24 varieties are enumerated which have proved healthy and fairly vigorous in that locality. The following provisional list covering a range of seasons is suggested: Early Harvest, Red Astrachan, Carter Blue, Limbertwig, York Imperial, Shockley, Red June, Horse, Ben Davis, Winesap, and Yates. "The two most serious enemies to profitable apple growing so far encountered are the various summer rots that attack the green fruit on the tree and

the green louse or aphis," the latter being very abundant, especially on young trees. It has not been found possible to rid the trees of them by kerosene emulsion. The apple scab is seldom seen. Notes are given on 20 varieties of Hungarian apples received from the Division of Pomology of this Department. "There were 3 trees of each kind, one of which had been grafted on a whole root, one on the upper half of a root, and one on the lower half of a root." Grafts on the lower half of the root made a slightly better growth than the others, and those on whole roots slightly poorer. In a test of northern as compared with southern grown apple nursery stock, Missouri-grown trees averaged 10 days earlier in starting than Georgia and Alabama stock, but before the end of the season there was no difference between them.

In a trial of Japanese as compared with French pear stocks for the South, Bartlett pears on the former were from the outset the more vigorous, and at the end of three seasons' growth averaged twice the size of those on French roots. In a trial of the Stringfellow root-pruning method with 8 varieties of peaches and 2 of pears, neither increase nor decrease of vigor could be detected in the root-pruned trees.

Observations made on the blooming seasons of 46 varieties of plums are given. The varieties are grouped as to time of blooming in the neighborhood of Auburn, each group comprising those blooming near enough together in ordinary seasons to effect cross pollination. A test of spraying with whitewash to retard blooming (E. S. R., 9, p. 835) showed little if any effect on time of budding.

Japanese persimmons, it is stated, grow readily in all parts of the State and bear well. Varietal notes are given on 9 sorts. Okame, Yeddo Ichi, Costata, and Yemon are recommended as the best market kinds.

Apples in Pennsylvania, G. C. BUTZ (*Pennsylvania Sta. Bul. 43, pp. 17*).—This is a popular bulletin, giving notes on soil, tilling the soil in young orchards, cultivation in bearing orchards, fertilizers, the trees, pruning at time of planting, distance to plant, pruning bearing trees, top grafting or double working, choice of varieties, preservation of apples, spraying, insect enemies, and fungus diseases. The greatest activity in Pennsylvania in the planting of apple orchards on a large scale is displayed at present in the southern and southwestern parts of the State. The author considers the York Imperial a variety of special promise in Pennsylvania.

Among the insect enemies of the apple are mentioned the codling moth (*Carpocapsa pomonella*), borers, oyster-shell bark-louse (*Mytilaspis pomorum*), cankerworm (*Anisopteryx pometaria*), aphis (*Aphis mali*), and tent caterpillar (*Clisiocampa americana*), and remedies are given.

Brief notes are given on the apple scab (*Fusicladium dendriticum*), rust (*Rœstelia pirata* and *Gymnosporangium macropus*), and leaf spot (*Phyllosticta limitata*), and remedies are suggested.

Tests of strawberries, raspberries, blackberries, and grapes, J. TROOP (*Indiana Sta. Bul. 73, pp. 78–92, figs. 3*).—Notes are given upon

numerous varieties of strawberries, raspberries, and blackberries, mostly new, tested at the station the past season. No recommended list of strawberries is given. Among raspberries, Miller, Cuthbert, Columbian, Golden Queen, Marlboro, Eureka, Kansas, and Nemaha are recommended; among blackberries, Agawam, Ancient Briton, Early King or Early Harvest (with protection), Eldorado, Erie, Snyder, Taylor, and Western Triumph. The author especially recommends thorough subsoiling before the setting of raspberries on land with a hard compact subsoil.

Cultural notes are given on the native grapes, and Brilliant, Campbell, Early Ohio, Nectar, Red Bird, and Ulster are recommended among the newer varieties as worthy of consideration.

Strawberry culture—notes on varieties, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Bul. 163, pp. 43–76, figs. 6*).—A general presentation of the subject, discussing the soil and its preparation, plants and planting, fall planting, varieties, perfect and imperfect flowered varieties, cultivation and care, mulching, preventing injury from frost, irrigation, cleaning out the old beds, insects and diseases, the strawberry weevil, and the strawberry-leaf blight. Notes upon a large number of varieties are appended.

"The most promising of the new sorts are Fountain, Hoosier, Knight, Morgan Favorite, Ridgeway, Seaford, Unnamed, and Mayflower for early and medium, and Michigan for late.

"Of the varieties that have been tested for two seasons the following have the most promise: Fremont, Giant, Glen Mary, Ideal, Purdue, Plow City, Ruby, and Wm. Belt.

"Notwithstanding the advent of the many newer sorts, it is doubtful if there are more profitable varieties for the market grower than Bubach, Haverland, and Warfield, with Beder Wood, Sharpless, or Clyde as fertilizers for these pistillates.

"For the grower of fancy fruit under intensive culture it is possible that the large fruiting sorts—Brandywine, Glen Mary, Marshall, and Wm. Belt—may be more profitable than the varieties named above that are usually more productive but bear smaller berries.

"Bird, Greenville, Leroy, Snowball, and Weston, among sorts not so widely known as the above, have given good results as market berries.

"Aroma and Eureka bear large fruits, are late, and have a long season. They are well worthy of trial as late varieties."

A native white bedding plant, J. C. ARTHUR (*Indiana Sta. Bul. 71, pp. 94–100, pls. 6, fig. 1*).—The essential motive of this bulletin is to call the attention of flower lovers to the ornamental possibilities of some species of our native flora. Notes are given on *Cerastium arvense oblongifolium*, to which the author gives the popular name starry grasswort, as a bedding plant. This plant has been under cultivation at the station for several years. It covers the ground with a close mat of foliage and is evergreen. It has merits also as a cut flower. The starry grasswort is believed to possess the necessary capacity for variation that is essential when rapid cultural improvement is demanded. Botanical and cultural notes are given.

Horticulture in Japan, J. K. M. L. FARQUHAR (*Florists' Exchange, 11 (1899), No. 12, p. 343*).

Evolution in the garden, F. W. BURBRIDGE (*Gard. Chron., 3. ser., 25 (1899), No. 639, pp. 177, 178*).—A criticism of the present confused nomenclature of garden plants, especially crossed plants, with suggestions for its simplification.

Orchard cultivation, J. T. STINSON (*Arkansas Sta. Bul. 55, pp. 87-100, figs. 7*).—A popular presentation of the subject, treating of location, soil, time for setting trees, distances between trees, how to transplant, how to prune, tillage, cover crops, and fertilizers. Apple skin blotch (*Leptothyrum pomi*) is mentioned as of rare occurrence in orchards on the highlands in the northwestern part of the State, but of extensive occurrence in less elevated locations. Experiments with the close root pruning method resulted somewhat unfavorably, but not decisively.

The science of fruit tree fruitfulness simplified (*Agr. Jour. Cape Good Hope, 14 (1899), No. 5, pp. 296-298*).—Abstract of an article in the *London Fruit Grower*. It is a polemic against the commonly accepted canons of fruit-tree pruning. Removal of wood growth in such quantities as usually practiced is believed to be devitalizing. Superfluous growth should be pinched out as soon as it appears. If any is overlooked, it should be cut in the winter months of the year in which it first grew and all weak young branches should be cut back at the same time.

The hardy fruit garden, C. HERRIN (*Gard. Chron., 3. ser., 25 (1899), No. 639, pp. 182-183, figs. 8; Amer. Gard., 20 (1899), No. 224, pp. 260, 261, figs. 8*).—Detailed directions for performing the operations of crown grafting, saddle grafting, side grafting, and whip grafting. An improved method of crown grafting is figured.

Some notes on cherries in Vermont, F. A. WAUGH (*Amer. Gard., 20 (1899), No. 220, pp. 177-179*).—Notes on a cooperative experiment with hardy cherries, mostly Russians, in Vermont. Reports on the cherries "were more full, complete, and favorable than those on apples, pears, or plums" distributed at the same time. Two explanations of this fact are suggested: "First, the cherries have thrived better under the varied methods of neglect under which they have fallen and, secondly, there are more good things among the Russian cherries than in any other class of Russian fruits." Many of the varieties have made a very favorable impression throughout the State. Descriptive notes are given of 16 varieties.

The lemon and lemon growing, T. J. ASHBY (*California Fruit Grower, 24 (1899), No. 11, p. 4*).—Brief historical and cultural notes.

The orange, W. J. ALLEN (*Agr. Gaz. New South Wales, 10 (1899), No. 2, pp. 154-162, pls. 4*).—Detailed cultural directions.

The currant vine in South Australia (*Gard. and Field, 24 (1899), No. 10, pp. 256-258, figs. 5*).

A fertilizer for strawberries (*Belg. Hort. et Agr., 11 (1899), No. 6, p. 84*).—The following fertilizer mixture is said to give very satisfactory results: 500 gm. nitrate of soda, 500 gm. sulphate of ammonia, 3 kg. superphosphate of lime, 2 kg. plaster, 2 kg. sulphate of iron. Apply the mixture in the spring at the rate of 200 to 300 gm. per square meter.

Vanilla planifolia, G. WYTHES (*Gard. Chron., 3. ser., 25 (1899), No. 641, p. 213, fig. 1*).—A gardener's method of procedure to secure a good crop of vanilla pods.

Landscape gardening for factory homes, W. H. TOLMAN (*Review of Reviews, 19 (1899), No. 111, pp. 441-444, figs. 6*).—An article relating how a manufacturer ornamented his factory grounds, and the means by which interest in landscape gardening was aroused in the factory operatives. The result was a general ornamentation of home grounds in the vicinity and the organization of a local improvement association. The factory people are now more contented and the value of real estate in the neighborhood has been enhanced.

Roadside treatment—actual and possible, MRS. F. H. TUCKER (*New England Florist, 5 (1899), No. 7, p. 74*).—A lecture before the Massachusetts Horticultural Society.

Naturalizing daffodils, E. BURRELL (*Gardening, 55 (1899), No. 1489, pp. 234, 235*).—Soil, not situation, is considered the important factor in the naturalization of daffodils. A deep sandy loam, with no suspicion of clogging or water logging, is considered best. If the soil is favorable, daffodils will thrive in any exposure, though a northwest aspect with very light soil is most desirable.

What is a cactus dahlia? H. F. BURT (*Amer. Gard., 20 (1899), No. 224, pp. 257, 258*).—Dahlias are divided, according to the shape of the ray, into three types, one of which is the cactus dahlia. This type is distinguished from the others by three fundamental characters, which are given.

Freesias, F. A. WAUGH (*Gardening, 7 (1899), No. 157, pp. 196, 197, fig. 1; Amer. Florist, 14 (1899), No. 569, pp. 1178, 1179, fig. 1*).—Suggestions for simplifying the confusing nomenclature of these flowers, and notes upon their amelioration.

Walls made of ashes and cement for solid beds, E. LONSDALE (*Amer. Florist, 14 (1899), No. 567, pp. 1117, 1118; Gardening, 7 (1899), No. 159, pp. 235–237*).—A cheap method is described of constructing the walls of greenhouse beds. Brick may be replaced by a material composed of 6 to 7 parts of anthracite coal ashes and 1 part good Portland cement, the top being finished off with a mixture of 2 parts of sand to 1 of cement.

FORESTRY.

A sketch of the original distribution of white pine in the lower peninsula, C. F. WHEELER (*Michigan Sta. Bul. 162, p. 5, map 1*).—In the lower peninsula of Michigan the white pine is said to have been generally distributed north of the forty-third parallel, although the actual southern limit of lumbering does not conform to this line. In 1835 it was said that the standing pine was estimated at 150,000,000,000 ft. In 1880, as reported by the census report for that year, the merchantable timber in the lower peninsula was estimated at 29,000,000,000 ft. and the total cut for that year was estimated at a little over 4,500,000,000 ft. The latest estimate of the standing white pine was made by the State Commissioner of Labor in 1896, in which it is shown there were approximately 775,000 acres of white pine still standing in the forests of Michigan.

The present condition of Michigan forest and stump lands, with suggestions as to their care, F. C. SKEELS (*Michigan Sta. Bul. 162, pp. 7–12, map 1, fig. 1*).—The present condition of the original forests of Michigan as stated shows that fully 90 per cent of all wooded lands in the State are owned by private parties who will convert the timber into merchantable forms as fast as the market will receive it. Much of the timber in these forests is said to be already past its prime, and it is thought that if the large owners could be interested in the proper cutting of the forests much good could be accomplished. In the maintenance of the present forests two things must be combated, timber thieves and forest fires. In order to accomplish this, legislation will be necessary whereby wardens will be provided for the protection of forests and stump lands. It is also thought that some means should be adopted to influence the owners of stump lands to deed them back to the State, which should have charge of the reforesting of these lands.

Government forests and their preservation, B. HERMAN (*Forester, 5 (1899), No. 4, pp. 76-79*).—A brief account of the extent of the forest reserves and the means employed to preserve them.

Foreign trees for the German forests (*Oesterr. Forst. u. Jagdw. Ztg., 17 (1899), No. 10, pp. 73, 74*).—Notes are given on a number of American and Japanese forest trees.

Forestry in the State of Washington, K. LUDOFF (*Ztschr. Forst. u. Jagdw., 31 (1899), No. 3, pp. 166-171*).—Notes are given on the extent and character of the forests of the State.

The relation between forestry and geology in New Jersey, A. HOLLICK (*Amer. Nat., 33 (1899), No. 385, pp. 1-14, map 1*).

Trees for rocky soils, S. M. MEEHAN (*Florists' Exchange, 11 (1899), No. 6, p. 128*).—Notes on trees particularly easy of cultivation in high latitudes and on stony grounds, and the distinctive merits of each in landscape planting. Trees recommended include all the birches, especially the European birch (*Betula alba*) and varieties, the paper birch (*B. papyrifera*), the poplar birch (*B. populifolia*), sweet birch (*B. lenta*), yellow birch (*B. lutea*), dwarf birch (*B. pumila*), American and European hornbeam, catalpa (*C. speciosa* and *C. bignonioides*), and pines.

The larch, A. CIESLAR (*Centbl. Gesam. Forstw. Wien, 25 (1899), No. 3, pp. 99-117, figs. 6*).—The value of larch as a forest tree is discussed and some of the difficulties experienced in its management are pointed out.

The nitrogen requirements of forest trees, M. I. DUDAN (*Oesterr. Forst. u. Jagdw. Ztg., 17 (1899), No. 12, pp. 89, 90*).

Investigations on the preservation of oak timber against worms, E. MER (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 26, pp. 1252-1255*).—The ringing and decorticating of tree trunks in the spring of the year previous to felling them is recommended. This action brings about the resorption of starch and deposition of tannin in the wood and consequently the timber is less liable to attack.

Forestry legislation, C. D. SMITH (*Michigan Sta. Bul. 162, pp. 32-39*).—The author reviews the various forestry laws of Michigan and briefly summarizes the more recent legislation relative to forestry in the other States.

Methods of reforesting pine stump lands, W. J. BEAL (*Michigan Sta. Bul. 162, pp. 13-17, fig. 1*).—Popular notes are given on the methods of replanting or reforesting the stump lands and suggestions given as to what species would be most desirable to plant.

SEEDS—WEEDS.

Seed-testing regulations (*Landw. Vers. Stat., 50 (1898), No. 3-4, pp. 317-324*).—The rules governing seed testing, adopted by the Association of Agricultural Experiment Stations in the German Empire at an extraordinary session held in Berlin, January 17, 1898, are given in full. The rules relate to the size of sample, method of sampling, size of test sample, genuineness, purity, absolute weight, volume, milling qualities of cereals, and germination, with special regulations relative to beet and grass seeds.

The regulation relative to disputed determinations was modified as follows: In case of dispute, a sample of the seed is to be sent to the experiment station at Tharand. Here three similar samples are taken and sent without intimation as to origin to three different seed laboratories within the association. The reports from these three stations are submitted to a special committee, which, without knowing anything about the origin of the seed or stations testing them, renders a decision which shall be final.

On the salt-water method of the selection of seeds, T. YOKOI (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 421–439*).—The method of selecting seed by specific gravity is said to have been practiced in China and Japan for more than 250 years. The author shows by a number of experiments that there is no constant relationship between the specific gravity and absolute weight of seed, owing to a number of factors, such as the varying quantity of fat, ethereal oils, water, free air, etc. It is also shown that the specific gravity is not an index of the actual amount of nutriment for the nourishment of a plantlet from a seed. A series of experiments with barley is quoted in which seed of the same specific gravity, but of different weights, and those having the same weight but different specific gravity, were compared. It appeared that seed having the greatest absolute weight produced larger plants than those of the highest specific gravity, showing that the absolute weight of the seed has an intimate relation to productive power, but the productive power has little or no relation to specific weight.

A method of selection by the use of salt solutions is described, in which different strengths of solution are employed for different kinds of seed. The results obtained by this method, though not scientifically accurate, are said to be much more satisfactory than the ordinary specific gravity tests, and the method is quite widely employed in Japan.

On the selection of rape seed, C. KOBAYASHI (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 440–468*).—Investigations were conducted to ascertain the relation between the absolute weight and specific gravity of rape seed, the relation between the absolute weight and specific gravity of the seed and their germination, and the relation between the specific gravity of rape seed and their oil content. Briefly summarized the conclusions are that seeds of medium specific gravity have a more regular shape, are large, plump, heavy, and consist mainly of the heavier seeds when compared with those having either maximum or minimum specific gravity. The relation of the specific gravity and absolute weight of rape seed to germination shows that seeds of medium specific gravity are always superior in their germinating capacity, and produce more vigorous seedlings than those having a much higher or lower specific gravity. Heavy seeds produce larger seedlings than lighter ones, and if the seed of a given variety of rape be divided into groups according to specific gravity and absolute weight, on the whole, that of medium specific gravity is best for sowing. In estimating the oil content of rape seeds, those having medium specific gravity were found richest in oil.

On the effect of soaking rice seeds, T. YOKOI (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 469–473*).—Attention is called to the loss in the dry weight of seeds, caused by soaking them in water for varying periods of time. A number of experiments are quoted in which it is shown that soaking seed for 24 hours entailed losses of from

1.05 per cent for maize to 13.22 per cent for flaxseed. It is further stated that maize and barley soaked for 30 days at 18° C. lost 33.7 and 27.12 per cent, respectively, of their dried weight. The author states that, notwithstanding the injurious effects of soaking seeds, the Japanese farmers are accustomed to soak their rice seeds for a number of days, generally from 3 weeks to, in some cases, 100 or more days before planting. The effect of this soaking for a long time on the germination of seed is noted, and it is said that 120 days' soaking destroys, even in favorable cases, 20 or 30 per cent of the seeds, and those surviving germinate with difficulty. Experiments were conducted in which rice seed was soaked in pure water for 100 days, after which the seed was dried and found to have lost 12.018 per cent of its dry matter. This loss is distributed as follows: Organic matter 11.955, composed of nitrogenous material 1.696 per cent and nonnitrogenous 10.259 per cent, and ash 0.063 per cent. Attention is called to the fact that in the water in which the seed has been soaked for this length of time a very small number of bacteria was to be found, the water remaining remarkably clear and not showing any discoloration, such as is usually found after soaking seed for a much shorter period.

The influence of ether upon the germination of seeds and spores, C. O. TOWNSEND (*Proc. Amer. Assoc. Adv. Sci., 47 (1898), pp. 409, 410*).—In order to determine the effect of ether upon the germination of seeds and spores, seeds soaked for 24 hours in pure water were transferred to a series of air-tight damp chambers holding 1 liter and containing, respectively, 1, 2.5, 5, and 10 cc. of ether dissolved in 100 cc. of water. The customary checks were maintained for comparison. It was found that 1 cc. of ether hastened the processes of germination slightly, but the subsequent growth of the seedlings was somewhat retarded. In those chambers containing 2.5 and 5 cc. of ether germination was considerably retarded, and an atmosphere containing 10 cc. prevented seeds from germinating. If seeds were removed from this strong atmosphere of ether at the end of from 7 to 10 days and placed under favorable conditions they germinated as readily as if they had not been placed in the ether atmosphere. On the other hand, if the seeds remained in the strong atmosphere of ether 2 weeks they seemed to lose their vitality. Similar results were obtained by placing spores upon plates of gelatin containing 10 cc. of sugar and placing the plates in a chamber containing ether vapors.

Weeds of cornfields, L. H. PAMMEL (*Iowa Sta. Bul. 39, pp. 25–52, pl. 1, figs. 38*).—Various classifications of weeds are given, based upon their origin and duration. The most serious weed pests in the cornfields of Iowa are the foxtail grasses, the bindweed (*Convolvulus sepium*), nut grass, and, in wet soils, the purple smartweed (*Polygonum muhlenbergii*). Of these, the foxtail grasses are the most troublesome. Descriptions are given of the most conspicuous weeds, together with maps showing their distribution throughout the State. Notes are given on the general treatment of cornfields for the eradication of weeds and some specific directions for destroying certain species.

Seed dispersal, W. J. BEAL (*New York: Ginn & Co., 1898, pp. 90, figs. 63*).—This handsome little book contains accounts of how various plants migrate through their adaptive arrangements for seed dispersal.

Absorption of water by rice seed, H. ANDO (*Imp. Univ. Col. Agr. [Tokyo] Bul., Vol. 3, No. 5, pp. 474–478*).—In order to ascertain the amount of water necessary for germination and the length of time required for rice seeds to absorb a sufficient quantity for their germination, the author conducted a series of experiments, from which it appeared that on the average 22.57 per cent of water by weight is required to saturate rice seeds, and this quantity of water is absorbed in 240 hours at a comparatively low temperature. This amount of water is said to be much more than sufficient for germination, and from the experiments it appears that soaking the seed for from 5 to 7 days is sufficient for them to absorb enough water to facilitate their germination.

The field mustard (Sinapis arvensis) and its destruction, G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 2, pp. 31–35*).

New South Wales weeds, J. H. MAIDEN (*Agr. Gaz. New South Wales, 9 (1898), No. 12, pp. 1371–1374, pls. 2*).—Notes are given on *Cyperus rotundus*, or nut grass.

A new weed on western ranges, L. H. DEWEY (*Erythea, 7 (1899), No. 1, pp. 10, 11*).—The presence of *Molucella lævis* on ranges in Oregon and Arizona is noted. The plant is an annual and stock will not eat it, hence it may become a troublesome weed.

Destruction of noxious weeds (*Queensland Agr. Jour., 4 (1899), No. 2, pp. 149, 150*).—Notes the use of iron and copper sulphates for the destruction of charlock and other weeds, and states that extensive experiments with these fungicides are to be conducted at Newcastle-on-Tyne.

DISEASES OF PLANTS.

Mycological notes, B. D. HALSTED (*Bul. Torrey Bot. Club, 26 (1899), No. 1, pp. 12–20, figs. 2*).—The author gives miscellaneous notes on a number of fungi, their influence upon their hosts, etc. He reports the presence during the month of May of a remarkable development of *Botrytis vulgaris* on garden peonies. The outer leaves of the plant were in a healthy condition, while all the inner ones were brown, lifeless, and overgrown with the fungus. A long-continued period of rainy weather preceding the discovery of this attack is thought to have had some influence upon the severity of the attack.

A rust of *Phlox subulata* is reported as quite abundant in the vicinity of New Brunswick, New Jersey. This rust is specifically different from *Puccinia plumbaria*, which is found abundant on *Phlox divaricata* and other species, but it agrees closely with *Puccinia giliæ*, a well-known western form.

Attention is called to the effect of sunlight on the development of leaf blight of cherry. Figures are given in which it is shown that the part of the leaf receiving the greatest illumination was most severely affected, and it is stated that possibly the exposure of the leaf to an excess of light brought about a scalding or browning of the tissue, and this in turn might prepare the way for better entrance of the fungus.

The influence of fungi on the fruitfulness of the host plant is shown in the effect produced by asparagus rust upon its host. It seems that the attacks of the fungus weaken the plant materially, reducing the

size of the autumn growth. The production of berries was very small, nearly all the plants appearing as if they were staminate. This exception to the general rule, that when the life of an individual is in danger there is an attempt to reproduce by seed, does not seem to arise so much from the rust actually blighting the flowers, but the flowers did not form, and in the great majority of plants there was no sign of reproduction.

An account is given of fatal poisoning by eating *Amanita phalloides*. The mushrooms were collected and eaten by mistake for innocuous forms.

Observations are recorded which tend to show that one fungus may develop in its host immunity from the attacks of another. Thus the common rust (*Puccinia mamillata*) of climbing smartweed was nearly always absent from those plants which were infested with *Ustilago anomala*. The same thing was found to be true in case of smutted specimens of *Panicum sanguinale*, the leaves of which are rarely affected with *Piricularia grisea*, while the normal plants have the foliage quite generally spotted with it. It is further stated that while fruiting radishes are frequently attacked by *Peronospora parasitica*, and others close at hand by *Cystopus candidus*, it is seldom that both fungi occur on the same individual.

The author points out the effect of fungi on the autumn coloration of foliage, stating that the common maple mildew (*Uncinula circinata*) causes the presence of green spots in the otherwise highly colored foliage of autumn.[1]

A late growth of the bean mildew (*Phytophtora phaseoli*) is reported, in which the fungus is said to thrive upon the pods after the plants have been killed by frosts.

Mycological notes, B. D. HALSTED (*Bul. Torrey Bot. Club, 26* (*1899*), *No. 2, pp. 72–78*).—A number of miscellaneous notes are given of observations and experiments made by the author at the New Jersey Experiment Station. Among the more important is an account of the use of lime for the prevention of club root of turnips. Five years' experiments, in which air-slaked lime had been placed on the soil at the rate of 150, 75, and 37½ bu. per acre, are reviewed. The yield of sound and diseased turnips for the different seasons is given, showing that the larger amount of lime nearly prevented the development of the club-root fungus. On the untreated plats its presence was quite evident, as seen by the large proportion of clubbed roots. The author states that from the tests of 5 years it seems probable that 35 bu. of lime per acre is ample to keep club root from land even when a susceptible crop is grown continuously.

The artificial introduction of onion smut (*Urocystis cepulæ*) was investigated. In the experiments, smut-infested soil was added to open rows before any seed was sown. Two varieties were grown in alternate

[1] This phenomenon has been previously noted by Waite in Burrill and Earle's Parasitic Fungi of Illinois, pt. 2, p. 409.—ED.

rows, but there seemed to be no difference in the susceptibility of the different kinds. No smutted onions were found outside of the inoculated belt, while it was abundantly present where the soil had been artificially transferred.

The use of beet leaves as tests for fungicides is commented upon, and the author states that the experience of 5 years leads him to conclude that the beet is one of the most suitable plants with which to experiment with fungicides, and of the different forms of beet the Swiss chard is one of the greatest value. Tests made upon Swiss chard in which Bordeaux mixture and soda Bordeaux were used indicate that the latter fungicide was somewhat more efficient in preventing the leaf blight. This fungicide is made according to the following formula: Caustic soda 1 lb., copper sulphate 3 lbs., lime 5 oz., water 30 gal. It has the advantage of Bordeaux mixture in the greatly reduced amount of lime and consequently in the greater ease with which it may be applied.

Brief notes are given on the susceptibility of bush beans to blight. Since 1894, 2 crops a year have been grown upon the same plat, using a number of varieties. Upon old land the Refugee proved the most productive and Flagolet the least, but in the proportion of spotted pods the results were reversed.

A brief account is given of investigations conducted upon sweet corn, in which it is stated that there was unmistakable evidence of the bacterial disease *Pseudomonas stewarti*, on the variety "First of All." Smut was also quite common in the same variety.

The value of rotation of crops in preventing plant diseases was strikingly shown by the writer in experiments with eggplants. One plat had been grown with this crop 3 successive years, and the crop of half of this plat was compared with that of another on which these plants had not been grown. There were five times as many sound fruits upon the new as upon the old land, and the decayed fruits were only 16 per cent on the new land as compared with 61 per cent on the old.

Observations have been continued on the use of sulphur as a remedy for potato diseases, and three sets of experiments are reported in which, on different years, sulphur was added to the soil in amounts ranging from 120 to 720 lbs. per acre. The seed potatoes in these experiments were treated with corrosive sublimate before planting and comparisons were made with them grown in sulphur treated soils and those receiving no fungicides. As indicated by the experiments, sulphur was efficient in greatly reducing the amount of potato scab, the average results of the different experiments showing a reduction of from 65.1 to 24.27 per cent.

Cotton rust, F. S. EARLE (*Alabama College Sta. Bul. 99, pp. 281–309*).—This disease is primarily due to physiological causes, which reduce the vitality of the plant so as to admit of the active growth of various fungi, of which the principal are *Macrosporium nigricantium*, *Alternari* sp., and *Cercospora gossypina*. It is largely confined to the

older cotton-growing States and prevails over considerable portions of North Carolina, South Carolina, Georgia, Alabama, and Mississippi. It is usually worse on old, worn, sandy lands, but may appear on any soil in which the humus has become exhausted. Plants on low, wet lands and seepy hillsides are also subject to the disease, while sporadic cases may be found in almost any soil under favorable conditions.

Experiments with this disease have been conducted at the station farm and also in cooperation with a number of planters, in which the efficacy of improving the soil by means of potash fertilizers has been tested with good results. From the different experiments it seems that by ameliorating these conditions, giving better drainage, incorporating more vegetable matter in the soil and supplying abundant plant food in complete fertilizers, especially those rich in potash, the disease may be almost wholly prevented. The author believes that by a greater diversification, so that crops will be grown in rotation, the condition of the soil will be improved to such an extent that the disease will be no longer troublesome.

The potato disease, H. M. WARD (*Ann. Bot., 12 (1898), No. 48, pp. 561-564*).—A potato disease which is not due to Phytophthora, and which has often been ascribed to bacteria, has been recognized here and there in England for a number of years, and for 2 years the author has conducted investigations on it. On the diseased plants the shoots turn yellow and die prematurely during the summer before the tubers have become anything like full grown. The disease starts from below and not from the leaves. The roots are few and soon rot away. The tubers do not mature and frequently rot in the ground. The leaves turn yellow and wither on the stems, with symptoms of premature wilting, and often remain hanging on the yellow, glassy-looking, but still living stems. In severe cases, especially in wet places, the stems and roots may all be rotted by the end of July, and casual observation would attribute as a cause the presence of Phytophthora. In mild cases the symptoms are not so obvious and the disease may be complicated by the presence of the Phytophthora fungus. In advanced stages of the disease the stems either dry up or rot on the wet ground. Very often bacteria gain access to the tissue at a comparatively early stage.

Sections across the lower part of the stem show one or more of the vascular bundles yellowish brown and the principal vessels contain branched septate hyphæ. In several cases these hyphæ have been traced from the leaves through every internode of the stem through the roots and into the tubers. In advanced cases the brown vessels are stopped with a yellowish gumlike substance. Those tubers which are not attacked while still very young, but which have begun to fill with starch, may offer considerable resistence to the invasion of the fungus; but eventually the vascular strands show the red or yellowish brown color, and in many cases the ripened tubers are to all appearances sound except for microscopic reddish spots at the point of

entrance of the vascular bundles. If gathered and stored dry during the winter but little change will take place in the tubers, but if stored wet various kinds of rot may attack them, the fungi living as saprophytes on the stored reserve.

The author states that this fungus leads the way for a number of purely saprophytic forms, and the evidence seems to show that the parasite is planted with the tubers. On this account the potato grower must exercise care in the selection of his seed and the preparation of his ground. In a subsequent paper the author intends treating the subject at greater length and expects to show that allowing the young shoots to lie in contact with the soil or manures is a possible means for spreading the disease. The same applies to wet soils and situations, and the disease is said to be particularly liable to increase when wet, cold weather follows early growth.

Diseases of the tomato, P. H. ROLFS (*Florida Sta. Bul. 47, pp. 115–153, pls. 2*).—This bulletin treats of some of the more important diseases that have been observed to attack the tomato in Florida.

The rust, black rot, spot, or black spot, due to *Macrosporium solani*, is figured and described. As a preventive remedy thorough spraying with Bordeaux mixture is recommended, at least two applications to be given the plants in the seed bed and the number of sprayings in the field varied with the conditions of the weather.

The bacterial blight of tomato (*Bacillus solanacearum*) is briefly described, the principal characters together with the treatment being largely drawn from Bulletin 12 of the Division of Vegetable Physiology and Pathology of this Department (E. S. R., 8, p. 895).

Experiments are reported in which the effect of fertilizers on this blight was tested, from which it appeared that while healthy, vigorous growing plants seemed to show the effects of the blight less quickly than the small, stunted ones, both ultimately succumbed to the disease. Different forms of potash and nitrogen were tested, but no single form seemed to be superior; bone phosphate was found no better than acid phosphate. A fertilizer which would tend to produce a strong, woody stem would be slightly better than one producing a rapid, succulent growth. The relation of different varieties to this blight was investigated and there seems to be some difference in susceptibility. Considerable advantage may be obtained in having the plants as widely separated in rows as possible, as this will tend to prevent the rapid spread of the disease.

A fungus blight of the tomato has been under investigation for about 6 years, but the conditions do not yet warrant the classification and identification of the organism present. When the plant is affected by this disease a single leaf may be observed to droop as though from want of moisture. Later it may regain its normal appearance, to resume its wilted condition in a day or so. In severe cases the whole plant may be affected in this way. A plant once affected rarely recovers, and

those varieties which have hard, woody stems are less susceptible than the succulent ones. Pouring fungicides, such as potassium sulphid, ammoniacal copper carbonate, or eau céleste, about the plants will tend to the suppression of this disease, as the principal portion of the life of the fungus is spent underground.

Notes are given on leaf blight, damping off, and the tomato worm, with suggested remedies for each.

A disease due to *Phytoptus calcladophora* is described. This mite appears to be confined, in the United States, to Florida, though doubtless the same disease has been reported from Spain and Italy. The mites attack the growing bud of the plant and later the fruit buds, causing white hairs to grow out from the epidermis, giving the plant a peculiar ashy white appearance in the affected parts. Applications of sulphur in the form of spray, such as recommended for the rust mite of the orange, or the sprinkling of the plants with flowers of sulphur have been found to be very efficacious.

Root knot, due to *Heterodera radicicola*, is briefly described, and when present the vines, after bearing, should be collected and burned and some other crop grown on the soil for a year or more.

Considerable loss has been reported due to the dropping of fruit buds from the vines. The causes have been investigated to some extent, and it was found due to partial arresting of the vegetative functions of the plants as well as the lack of fertilization. Another cause, which is capable of being controlled, is too great vegetative growth, and this can be prevented by topping the plants.

Tomato plants are reported as frequently suffering from what is described as hollow stem immediately after being set out from the seed bed. Plants so affected make little or no growth. The causes which produce this trouble are stated to be highly nitrogenous soil in the plant bed, an abundance of water to make the fertilizers quickly available, a quick-growing variety of tomatoes, transplanting without hardening off, and planting into a dry soil necessitating the use of water. The author states that several of these causes acting in conjunction will produce the disease. Its prevention is quite obvious from the causes to which it is attributed.

The stem-rot diseases of the carnation, F. C. STEWART (*Bot. Gaz., 27 (1899), No. 2, pp. 129, 130*).—The author states that at least two distinct diseases of carnations have been confused under the names "stem-rot" or "die-back." One is caused by Rhizoctonia; the other is due to a Fusarium. Both diseases are said to be common in the field and greenhouse. The Fusarium attacks chiefly the stem and larger branches, discoloring the wood and killing the cortex, but rarely causing a soft rot. The affected plants die gradually with yellowing or drying foliage. The fungus rarely fruits on the outside of the stem, but does so frequently in the cambium and pith of stems which have long been dead.

The Rhizoctonia causes the plants to wilt suddenly by rotting the

stem at or just below the surface of the soil. The cortex separates readily from the wood, the pith is attacked quite easily, becoming water-soaked in appearance and filled with hyphæ.

Penicillium as a wood-destroying fungus, H. M. WARD (*Ann. Bot.*, *12* (*1898*), *No. 48*, *pp. 565, 566*).—Spores from pure cultures of Penicillium were sown on sterilized blocks of spruce wood cut in March and were found to grow freely and develop large crops of spores. Sections of the infected wood show that the hyphæ of the mold entered the starch bearing cells of the medullary rays, consuming the whole of the starch. In cultures 3 months old the hyphæ were seen deep in the wood, passing from tracheid to tracheid through the bordered pits. Control sections, kept side by side with the others but not artificially inoculated, showed no trace of the mold. On account of the common occurrence of this fungus and its well known resistance to fungicides it must be considered an important destroyer of timber.

Nematode worms, G. E. STONE and R. E. SMITH (*Massachusetts Hatch Sta. Bul. 55*, *pp. 67*, *pls. 12*, *figs. 2*).—After describing the symptoms of nematode injuries, comparisons between the galls caused by nematodes and those of club roots, leguminous tubercles, insects, etc., the authors give in considerable detail descriptions of the parasitic gall-forming nematode, *Heterodera radicicola*. The life history of the different forms of this nematode are described, from which it appears that the young worms come into the soil from previously infected plants and wander about until they find roots suitable to their attacks. Forcing their way into the younger portion of the roots they embed themselves in its tissues, and this irritation causes an abnormal development of the root. The worms increase in length and much more in diameter, assuming a spindle and afterwards a club shape. The females continue this swelling process until they have the shape of a gourd and are of a size just about visible to the naked eye. By this time they are mature and after being fertilized produce eggs. The life period of the female is said to be about 6 weeks. The male worms do not remain in the swollen form but after about 4 weeks from the period of entering the root they change into a slender worm-like form which enables them to move about and seek the females with which they copulate, and then perish. While the worms are developing the abnormal growth of the root continues and results in the gall-like swelling or enlargement and such a disarrangement of the tissues that the progress of the sap through the plant is hindered.

An historical review is given of some of the earlier literature relative to this pest and the identity of the species is discussed. The authors think that *H. radicicola* and *H. schachtii* are probably one and the same species.

The second part of the bulletin treats of the economic consideration of the subject relative to means for controlling these pests. In northern United States the greatest amount of injury done is to plants in

greenhouses, although not infrequently outdoor plants are subjected to nematodes by being brought into contact with infested earth or manure. At the station it was found that the eggs will not survive the winter. The various means which were tested for destroying the adult worms are reviewed at some length. The use of chemicals for this purpose is of no practical value. While there are many chemicals which will kill the adult worms yet the most effectual, complete, and practical method for exterminating nematodes in greenhouses is by sterilizing the soil by means of steam. This is best effected under a steam pressure somewhat in excess of 50 lbs. The minimum amount of heat necessary to kill nematodes and eggs when found in the soil is about 140° F., but, for all practical purposes, it was found desirable to make use of higher temperatures ranging from 180 to 212° F. This steam sterilizing of the soil, in addition to destroying the nematodes, killed many other greenhouse pests, greatly improved the mechanical condition of the soil, and rendered the humus compounds more available for plant food, which resulted in giving the plants a considerable acceleration in their rate of growth.

Investigations on means for increasing adherence of fungicides, J. PERRAUD (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 22, pp. 876–879*).—In order to ascertain the degree of adherence of a number of fungicides, the author conducted a series of experiments with a solution of 2 per cent copper sulphate rendered slightly alkaline with fat lime, 2 per cent copper sulphate and 2 per cent fat lime, 2 per cent copper sulphate rendered slightly alkaline with slaked lime, 2 per cent copper sulphate rendered slightly alkaline with sodium carbonate and neutral copper acetate. To these different solutions a number of substances were added to render them more adherent. Among those used were dried blood, the white of egg, gum tragacanth, glue, starch, dextrin, potassium silicate, molasses, aluminum sulphate, soap, and resin. Eau celeste was also tested. After spraying these upon grape leaves and fruits and allowing them to dry for 2 hours in the sun, both the fruit and leaves were subjected to an artificial rain amounting to 4 mm. and the percentage of copper adhering to them determined. The results show that all the modern fungicides are less adherent to the fruit of the grape than to the leaves. From the standpoint of their adherence the fungicides tested are reported in the following order: (1) The solution of copper sulphate made slightly alkaline with carbonate of soda; (2) the copper sulphate solution made slightly alkaline with fat lime; (3) the solution in which equal quantities of copper and lime were used; (4) neutral copper acetate; (5) eau celeste and (6) copper sulphate and slaked lime.

Of the substances used to increase the adherence of the fungicides, resin was by far the best, followed by soap, potassium silicate, molasses, gum tragacanth, and glue. The other substances employed either were without apparent effect or seemed to diminish the adherence of the fungicides. It is ascertained that the nature of the lime which enters

the preparation of Bordeaux mixture is of great importance. Quick lime only should be used, and it should be slaked at the time of using. On account of the remarkable adherence of resin mixtures, especially on the fruit, the author proposes continuing investigations with fungicides containing this substance.

Means for preventing the introduction of plant diseases, J. E. WEISS (*Prakt. Bl. Pflanzenschutz, 2 (1899), No. 1, pp. 5, 6*).

Contributions to the knowledge of parasitic fungi, G. LAGERHEIM (*Vet. Akad. Handl. Bihang K. Svenska, 24 (1898), No. 4, pp. 2, pls. 3; abs. in Bot. Centbl., 77 (1899), No. 12, pp. 405, 406*).—Notes are given on *Cladochytrium alfalfæ* n. sp., parasitic on alfalfa, *Empusa phalangicida* n. sp. on insects, and *Iola* (*Cystobasidium*) *lasioboli* n. sp. on *Lasiobolus equinus*.

Apple and pear scab, G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 5, pp. 157–160*).—Notes are given on *Fusicladium dendriticum* and *F. pyrinum*, and the use of Bordeaux mixture is recommended for preventing the diseases.

Combating the leaf diseases of fruit trees, P. HELD (*Deut. Landw. Presse, 25 (1898), No. 92, p. 966*).—Brief descriptive notes are given on a number of fungi attacking the leaves of fruit trees and directions for combating them. Bordeaux mixture, copper-soda solution, Burgundy mixture, and sulphur are the fungicides recommended.

A disease of peach trees, J. RITZEMA-BOS (*Tijdschr. Plantenziekten, 4 (1898), No. 5, pp. 146–154*).—Notes are given on *Monilia fructigena*.

A report on the diseases of the chestnut in the Pyrenees, Basque Provinces, Spain, and Portugal, L. CRIÉ (*Bul. [Min. Agr. France], 18 (1899), No. 6, pp. 1291–1313*).

Studies of the hexenbesen rust of barberry, J. ERIKSSON (*Beitr. Biol. Pflanz., 8 (1898), No. 1, pp. 1–16, pls. 3*).—Studies on *Puccinia arrhenatheri*.

A destructive disease of conifers, DOSCH (*Ztschr. Landw. Ver. Hessen, 1898, No. 39, pp. 385, 386*).

On the appearance of a sereh-like disease of sugar cane, M. RACIBORSKI (*Meded. Proefstat. Suikerriet West Java, No. 36, pp. 5–10*).

The "Dongkellan" disease of sugar cane, M. RACIBORSKI (*Meded. Proefstat. Suikerriet West Java, No. 36, pp. 1–5*).—A description is given of this disease, together with notes on its distribution. It is said to be very distinct from the disease described by Wakker under the same name.

Pestalozzia diseases of seedlings, J. RITZEMA-BOS (*Tijdschr. Plantenziekten, 4 (1898), No. 6, pp. 161–172, pls. 3*).—Notes are given on attacks of *Pestalozzia hartigii* and *P. funerea* on *Pseudotsuga douglasii*, *Chamæcyparis menziesii*, Biota, Cupressus, Juniperus, Pinus, etc.

A bacterial disease of the leaves of Oncidium, V. PEGLION (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 1, pp. 33–37*).—An organism, to which the name *Bacterium oncidii* n. sp. is given, has been isolated and the author claims by his experiments to have demonstrated that it causes a serious disease of these plants which are cultivated to a considerable extent in Italy. The organism is 1.3 to 1.5 μ in length and 0.8 to 1 μ in diameter and is said to grow readily in the more common culture media.

The common parasite of the powdery mildews, D. GRIFFITHS (*Bul. Torrey Bot. Club, 26 (1899), No. 3, pp. 184–188, pl. 1*).—Notes are given of *Ampelomyces quisqualis* parasitic on a number of the powdery mildews. This parasite has usually been referred to under the generic name Cicinobolus.

Concerning a parasite of Lactarius deliciosus, R. MAIRE (*Bul. Herb. Boissier, 7 (1899), No. 3, pp. 137–143*).—*Hypomyces vuilleminianus* n. sp. is described.

A parasite of Lactarius torminosus, R. MAIRE (*Bul. Herb. Boissier, 7 (1899), No. 3, pp. 144, 145*).—*Hypomyces thiryanus* n. sp. is described.

Root swellings of sugar beets, S. STOKLASA (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 3, pp. 95–98*).—Two forms of excrescences are recognized, one where the excrescence is joined to the upper or middle part of the root by a constricted growth and

the other a more general outgrowth of the lower part of the root. The first is of rather general distribution, while the other occurs sporadically. These outgrowths are due to several causes, nematodes among others, which interfere with the normal development of the root. In such tissues the sugar content is lowered very considerably over the rest of the root.

On a possible cause of the leaf spot or mosaic disease of tobacco, M. W. BEIJERINCK (*Centbl. Bakt. u. Par., 2 Abt., 5 (1899), No. 1, pp. 27–33*).—It is claimed that the cause of this disease, and probably that of other plants which have hitherto been unexplained, may be attributed to what the author terms a living fluid contagium.

Chlorosis in plants, G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 4, pp. 97–115*).—The possible causes of chlorosis are discussed and means suggested for its prevention. Applications of iron sulphate to chlorotic plants is recommended.

Effects of lightning on the grapevine, L. RAVAZ and A. BONNET (*Prog. Agr. et Vit. (ed. L'est), 20 (1899), No. 13, pp. 392–399, pl. 1, fig. 1*).—Notes the injury to many vineyards in the vicinity of Montpellier and states that many so-called diseases may be due to this cause, the injury preparing the way for numerous fungi and bacteria.

Experiments for the prevention of potato scab, WILFARTH (*Deut. Landw. Presse, 25 (1898), No. 25, pp. 273, 274*).—Experiments with "Sulfarin," a patented article said to be composed of keiserit with 15 per cent of free sulphuric acid, are reported. The powder was applied to the tubers and was efficient in reducing the proportion of scabby tubers, but the yield was also diminished.

On the treatment of seed potatoes with Bordeaux mixture and formalin, G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 3, pp. 65–71*).

ENTOMOLOGY.

Proceedings of the tenth annual meeting of the Association of Economic Entomologists (*U. S. Dept. Agr., Division of Entomology Bul. 17, n. ser., pp. 104, figs. 4*).—At this meeting, held in Boston, Massachusetts, August 19 and 20, 1898, the following papers were read:

The duty of economic entomology, H. Osborn (pp. 6–12).—This is the president's address to the Association. The matter is summed up under three heads: (1) Acquisition of knowledge of life and habits and direct remedies; (2) a knowledge of distribution and methods of prevention or control; and (3) education of people to appreciation of this need and to intelligent methods of application.

Two beneficial insects introduced from Europe, L. O. Howard (pp. 13–16, figs. 2).—This gives an account of the importation by the author of *Scutellista cyanea*, a Chalcidid parasite of Ceroplastes. The parasite was imported from Italy and has probably been successfully established at Baton Rouge, Louisiana.

The author also relates the accidental importation near Boston of another Chalcidid parasite, *Habrolepis dalmanni*, which attacks the imported scale, *Asterodiaspis quercicola*. The scale seems to be thoroughly established about Boston and the parasite is also present in large numbers.

Notes on some of the insects of the year in the State of New York, E. P. Felt (pp. 16–23).—This paper gives many biological and economic details concerning a number of the more common injurious insects.

The brown-tail moth, C. H. Fernald (pp. 24–31).—It is stated that the moth was first discovered in this country in the spring of 1897 in Somerville, Massachusetts. The center of infestation was in the vicinity of a florist who had imported roses and other shrubs from France and Holland. From the evidence at hand it appears that the brown-tail moth had been introduced as early as 1885. The distribution in this country is confined to a part of Somerville, Cambridge, Everett, Medford, and Malden. A brief account is given of the life history of the moth and of the nettling effects of the hairs of the caterpillar, and the author gives a long list of food plants upon which the caterpillar has been found.

Among its parasites are mentioned *Phæogenes hebe*, *Diglochis omnivora*, *Euphorocera claripennis*. The Baltimore oriole, black-billed cuckoo, crow blackbird, and English sparrow are also reported as feeding upon the insects. Spraying experiments were tried with arsenate of lead 1 lb. to 150 gal. of water, Paris green 1 lb. to 150 gal. of water, and Scheele's green 1 lb. to 150 gal. of water. Good results were obtained from all 3 insecticides. The author states that the "remedies generally adopted for the brown-tail moth are to cut off and burn the webs during the winter while the young caterpillars are still within them." The Massachusetts legislature has passed a law authorizing the Board of Agriculture to take steps for the extermination of the moth.

The distribution of the San José or pernicious scale in New Jersey, J. B. Smith (pp. 32–39).—A detailed account is given of the present status of the San José scale in New Jersey, and of the three main centers of infestation. In the older infested places the scale is said to have become much reduced in numbers.

Hydrocyanic-acid gas as a remedy for the San José scale and other insects, W. G. Johnson (pp. 39–43).—The author gives a record of experiments with this gas in the laboratory and in the field and concludes "that nursery stock and young trees of 1 and 2 years old to be replanted should be exposed to the gas for 30 minutes or longer, and that from 0.18 to 0.25 gm. of potassium cyanid should be used for every cubic foot of air space inclosed." On large bearing trees 0.20 gm. of cyanid gave the best results.

Some notes on observations in West Virginia, A. D. Hopkins (pp. 44–49).—This article contains brief notes on the following insects: The San José scale (*Aspidiotus perniciosus*), Forbes scale (*A. forbesi*), asparagus beetle (*Crioceris asparagi*), timothy billbug (*Sphenophorus sculptilis*), timothy-leaf miner (*Odontocera dorsalis*), clover-seed chalcidid (*Brucophagus funebris*), rose aphid parasite (*Ephedrus incompletus*), spruce gall mite (*Chermes abietis*), Cerambycid and Buprestid beetles, *Lymexylon sericeum*, *Eupsalis minuta*, and the periodical cicada (*Cicada septendecim*).

Notes on house flies and mosquitoes, L. O. Howard (pp. 55, 56).—This is the author's abstract of an article published as Circular No. 36, 2 ser., Division of Entomology (E. S. R., 10, p. 654).

Pulvinaria acericola (W. & R.) *and P. innumerabilis* Rathv., *L. O. Howard* (pp. 57, 58).—The author gives grounds for separating the Pulvinaria found on maples into the 2 species mentioned.

An abnormal Coccinellid, A. F. Burgess (pp. 59, 60).—The paper contains an account of melanism in *Adalia bipunctata*, a number of black individuals occurring in connection with typical specimens.

Notes on some Massachusetts Coccidæ, R. A. Cooley (pp. 61–65.)—This contains an account of observations on the maple-leaf louse (*Pseudococcus aceris*), *Aspidiotus forbesi*, *A. ancylus*, *A. fernaldi*, and *Diaspis amygdali.*

Notes on spruce-bark beetles, C. M. Weed and W. F. Fiske (pp. 67–69).—The beetles in question are said to belong to the species *Dendroctonus rufipennis.* In describing the habits of the insect the authors say: "In a space 15 in. long by 5 wide no less than eight burrows were discovered. They were in all stages of development, from a mere hollowing in the bark containing a single beetle, to a tunnel 2 or 3 in. long, and in these cases also there was usually but one inhabitant, though it was not rare even to find the male still accompanying his spouse."

Notes on the life history of the woolly aphis of apple, W. B. Alwood (pp. 70–72).—The author's object in his experiments was to determine the part which the sexual form plays in the life history of the insect, and to study the hibernation of the agamic form.

"Such trouble was experienced in rearing the sexual individual that we were not able to make extensive observations on oviposition, nor were we able to carry eggs over to the hatching period to produce a stem mother, but they were carried long enough to conclude that the egg does not hatch in the autumn. . . .

"From the long series of observations made, covering nearly 2 years, it is concluded that the sexual form plays a very unimportant part in the propagation and perpetuation of the species in this latitude.

"The agamic individuals are always present, usually in great numbers on the roots and to a less extent on the stems of the apple trees, and these colonies persist, so far as our observations go, and reproduce other agamic individuals in a direct line without cessation and without apparent loss of virility."

On the life history of Protoparce carolina, W. B. Alwood (pp. 72–74).—The record kept was for Blacksburg, Virginia. The first moths were observed June 7. The egg laying began June 20 and continued until the middle of July. Four moltings were observed, and the insect was found to be partly double brooded. *Apanteles congregatus* and a species of Chætolyga are recorded as parasites of the larva of Protoparce.

Notes on the fertilization of muskmelons by insects, F. W. Rane (pp. 75, 76).—The author states that the perfect flowers of the muskmelon have nearly as much pollen as the staminate ones and that the purpose of the staminate flower seems doubtful. Fertilization by insects is said to be the natural method, but the insects concerned are not named.

Notes on tent caterpillars, C. M. Weed (pp. 76–78).—Heavy spring rains in conjunction with a bacterial disease are said to have destroyed 90 per cent of the larvæ of the American tent caterpillar.

The most abundant insect parasite which came under the author's observation was *Pimpla conquisitor*. It is stated that the forest tent caterpillar (*Clisiocampa disstria*) is gradually becoming more destructive in New Hampshire and is injuring nearly all deciduous shade trees.

Recent work of the gypsy moth committee, E. H. Forbush (pp. 78, 79).—The writer states that the purpose of the committee has been and still is to work from the outer limits of infestation by the gypsy moth toward the central portions. The committee, it is stated, is more hopeful than ever of ultimate success in exterminating the gypsy moth.

The San José scale in Connecticut, W. E. Britton (pp. 81–84, fig. 1).—This paper contains a history of the importation of the scale into the State and an account of its present distribution.

Insect injury to millet, F. H. Chittenden (pp. 84–86).—Two species of flea-beetles (*Chætocnema denticulata* and *C. pulicaria*) are recorded as attacking millet on the grounds of the Department of Agriculture. The larva of a wireworm (*Monocrepidius bellus*) was found in some numbers about the roots of the millet and is recorded as injurious for the first time. The larvæ of *Diabrotica 12-punctata*, of a species of Lachnosterna, and of *Chlorops assimilis* were found injurious to the roots of millet.

Entomological ethics, T. D. A. Cockerell (pp. 87–90).—This paper sets forth the author's ideas of the ethical principles which should govern station entomologists.

Vernacular names of insects, E. W. Doran (pp. 90–92).—This article contains a list of common names of insects written as proposed by C. P. Gillette and as preferred by the author.

Notes from Maryland on the principal injurious insects of the year, W. G. Johnson (pp. 92–94).—The author gives brief details of the life history and remedial treatment of certain injurious insects.

Notes on insecticides, C. L. Marlatt (pp. 94–98).—The writer records results obtained in experiments with pure kerosene, fish-oil soaps, and arsenite of copper. It is concluded that "treatment with oil is dangerous and may kill the trees." The objections to fish-oil soaps are two: (1) The solution is usually gelatinous and difficult to use as a spray, and (2) substances like silicate of soda are frequently used in making these soaps, which destroy their insecticide value.

Insects of the year in Ohio, F. M. Webster and C. W. Mally (pp. 98–102).—The authors give notes on a large number of injurious insects. A report is made of experiments with kainit to prevent the attack of wireworms. It was found to have no value for this purpose.

Some miscellaneous results of the work of the Division of Entomology (*U. S. Dept. Agr., Division of Entomology Bul. 18, n. ser., pp. 101, figs. 17*).—*The San José scale on dried fruit, L. O. Howard* (pp. 7–13).—On account of the action of the Swiss Government in excluding American dried fruits, some experiments were undertaken to determine whether the San José scale could live through the evaporation and drying processes to which fruits are subjected for exportation. Fruits

were dried by both processes and all San José scale were found dead at the end of the experiment.

A new coccid on birch, H. G. Hubbard and T. Pergande (pp. 13–26).—The article contains an exhaustive technical description of the anatomical characters and of the different developmental stages of *Xylococcus betulæ.*

The peach lecanium, T. Pergande (pp. 26–29).—This insect, which has been considered identical with the European *Lecanium persicæ*, is shown to be a new species and is described as *L. nigrofasciatum.*

The work against Icerya purchasi in Portugal, with an account of the introduction from America of Novius cardinalis, L. O. Howard (pp. 30–35).—The article gives an account of the successful introduction of the well-known ladybird into Portugal, where it has already cleaned many badly infested orchards.

Twig pruners and allied species, F. H. Chittenden (pp. 35–43).—The habits and life history of *Elaphidion villosum* are given in detail. The article contains also brief notes on *E. inerme*, *E. subpubescens*, *E. mucronatum*, *E. tectum*, *E. cinereum*, *E. irroratum*, *E. unicolor*, and *E. imbelle.*

A destructive borer enemy of birch trees, with notes on related species, F. H. Chittenden (pp. 44–51).—The author relates an attack of *Agrilus anxius* upon the European white birch and other species of birch in the city of Buffalo. Correspondents from that city are of the opinion that unless the ravages of this beetle can be stopped all birch trees in the city will be destroyed. A careful description is given of the different stages of the insect and an account of the literature referring to this species.

As means of control the author suggests wrapping the birch trees with paper or covering them with whitewash, or the use of hydraulic cement and skimmed milk of the consistency of thick paint. The author says, "Preventives used should be applied to the trees just before the issuance of the beetles, which may be in some localities at least as early as the latter days of May. If paper wrappings are used, they can be removed as soon as the danger season is past, which will be within two or three months of the time of the first appearance of the beetles."

A new nomenclature for the broods of the periodical cicada, C. L. Marlatt (pp. 52–58).—In this paper the author proposes a new numbering of the broods of the periodical cicada, so as to show more clearly the relationship of the different broods to one another and their sequence in time of appearance. The 17-year races are placed first, and the broods are numbered from I to XVII, inclusive. These are followed by the 13-year races, of which the broods are numbered from XVIII to XXX. Some of these numbers have as yet no broods assigned to them. The grounds upon which this new numbering is based may perhaps best be stated in the author's own words: "As a rule, the relationship of the broods in point of distribution agrees with their kinship as indicated by their sequence in time of appearance. The relationship indicated by the latter, viz, their sequence in time, is doubtless untrust-

worthy as indicating origin, in some instances, on account of the uncertainty arising from the action of the principle of retardation, on the one hand, and acceleration, on the other, in the forming of new broods."

A consideration of the validity of the old records bearing on the distribution of the broods of the periodical cicada, with particular reference to the occurrence of Broods VI and XXIII in 1898, C. L. Marlatt (pp. 59–78).—The author gives the result of an investigation which was undertaken to determine the distribution of Brood XXIII of the 13-year race and of Brood VI of the 17-year race. Circular letters were sent to several thousand correspondents, and from the replies the distribution of these broods has been outlined by counties and localities much more definitely than has heretofore been done.

Some observations on the cycle of the sexual development of the blood louse (Schizoneura lanigera), S. Mokrzhetski (pp. 78–81).—This paper contains biological details of the life history and development of this insect, together with notes on the means of transportation of the insect from one locality to another.

A cecidomyiid injurious to seeds of sorghum, D. W. Coquillett (pp. 81, 82).—Seeds of sorghum which were received from the Texas Station were found to be infested by an insect which upon examination proved to be a new species and is described by the author under the name of *Diplosis sorghicola*. In the seeds which the Department received these insects were very numerous, and the only parasite which was noticed upon them was the genus of Chalcis flies known as Apostrocetrus.

A leaf tier of grape and elderberry, F. H. Chittenden (pp. 82, 83).—The author relates that in the summer of 1897, at Colonial Beach, Virginia, he noticed numbers of the larvæ of a pyralid moth which had the habit of folding the leaves of grapes together and joining them with a sort of web. When reared, the moth proved to be *Phlyotænia tertialis*. Later investigations disclosed the fact that the same species lives upon the elder and has the same habit upon that plant. The species is recorded from Maine, New Hampshire, Massachusetts, New York City, Pennsylvania, Onaga, Kansas, and Colonial Beach, Virginia.

A flea-beetle living on purslane, F. H. Chittenden (pp. 83–85).—At Marshall Hall, Maryland, the author found eggs of the flea-beetle which when reared proved to be those of *Disonycha caroliniana*. The larvæ of the beetle feed upon the common purslane, *Portulaca oleracea*. A technical description is given of the larva and pupa. Both the larval and pupal forms are said to resemble very closely another species of the same genus, *D. xanthomelæna*.

Cotton-field insects (pp. 85–88).—A correspondent of the Division having set out three trap lanterns for one night near Victoria, Texas, forwarded for examination the insects which were taken. In all the catch contained 24,492 specimens, representing approximately 328 species. The injurious species numbered 13,113 specimens, the beneficial 8,262 specimens, and those of a negative character 3,117 specimens. The object of the experiment was to determine whether the Mexican

cotton-boll weevil could be captured by these traps. Not a single specimen of the insect was found.

Under the caption "General notes" are appended to the bulletin observations of an economic character upon a large number of injurious and other insects, as well as many notes from the various correspondents of the Division in different parts of the country.

Twentieth report of the State entomologist on the noxious and beneficial insects of the State of Illinois, S. A. FORBES (*pp. 112+XXXII*).—The report treats of the San José scale, white grubs, chinch bug, *Odynerus foraminatus*, and a new disease of the army worm. In an appendix to the report, E. L. Storment gives an account of the white-pine Chermes.

Concerning the San José scale, the author gives a list of its food plants, and an account of the nature of the injuries which are caused by the insect. The means and agents concerned in the dispersal of the insect are discussed at some length. On the authority of Professor Stedman, it is stated that many new colonies have been observed in their incipient stages on branches and twigs which support bird nests. This is interpreted as indicating the instrumentality of birds in the dispersal of the scale. The original home of the insect and its early geographical distribution in the United States are briefly discussed.

The San José scale is said to have been first introduced into Illinois during the period from 1886 to 1891. Twenty-one distinct colonies have been located in Illinois, and of these colonies all which have been definitely traced to their origin are said to have come from nurseries in New Jersey. A detailed description is given of the different infestations. In one of the worst-infested orchards a spraying experiment was tried. Whale-oil soap in the proportion of 2 lbs. to a gallon of water was applied hot. The first application was made in November and a second one late in March. This method proved quite effective, and it was estimated that 99 per cent of the scales were destroyed by the two applications. The appearance of the insect is briefly described and an account of its life history is given.

Among the natural checks on the multiplication of the scale are mentioned certain climatic conditions, predaceous and parasitic insects, and fungus diseases. The most important insect parasites are said to be *Aphelinus fuscipennis*, *Chilocorus bivulnerus*, and *Smilia misella*.

Field notes are also recorded of a remarkable outbreak of white grubs. The species concerned were *Lachnosterna fusca* and *L. hirticula*. The grubs were reported as being unusually numerous about the roots of all field crops except clover, which enjoyed a comparative immunity. Crops on high land suffered more than those on low land, and fields in the vicinity of woodland were more infested than fields which were more distant from timbered areas. A brief life history of the white grub is given, and remedies are suggested, among which may be mentioned the pasturing of infested fields with pigs and the use of clover in the rotation of crops.

Experiments with summer remedies against chinch bugs demonstrated the efficacy of the barrier and post-hole method. To protect a field from the advancing chinch bugs a dust furrow is made along the side of the field. The chinch bugs have great difficulty in crossing a dry dusty furrow and crawl along the furrow to find an avenue of escape. In so doing they fall into post holes, which it is recommended to dig at intervals as traps for the accumulating chinch bugs. A coal-tar line about three-fourths inch broad is said to be as effective as the dust furrow, provided the tar-line be freshened two or three times per day. Salt saturated with kerosene is said to have been quite ineffectual as a barrier.

After an extended discussion of the causes of unusual outbreaks of the chinch bugs, the author observes that—

"As a general result of these investigations, we certainly have no warrant for asserting that the natural agencies effective in reducing an extraordinary outbreak of the chinch bug can now be definitely controlled by us for economic ends. So far as ascertained the final causes of unusual natural destruction of this insect are meteorological; and until the weather of the season, or even of the year, can be foretold with approximate definiteness and certainty, we can not forecast the course of events with respect to injuries by the chinch bug."

A species of solitary wasp (*Odynerus foraminatus*) is recorded as frequently building its mud nests in the opening for the escape of air from the retaining valve of automatic brakes such as are used on freight trains. As a remedy it is suggested that the passageway from the valve be made angular or slit-like.

An apparently new and undetermined disease is said to have caused great destruction of the army worm. The nature of the disease was not discovered, but one of its most marked peculiarities is said to be the degeneration of the fatty bodies of the caterpillars.

The account of the white-pine Chermes (*Chermes pinicorticis*) includes a list of its food plants, its economic importance, feeding habits, and distribution. Among the natural enemies of the Chermes are mentioned *Syrphus* sp. ? *Chryropa robertsoni*, *Hemerobius alternans*, *Leucopis simplex*, *Chilocorus bivulnerus*, and *Megilla maculata*. The only artificial remedy which was tried was kerosene emulsion. It was applied in May and proved very effective.

Thirteenth report of the State entomologist on injurious and other insects of the State of New York, 1897, J. A. LINTNER (*Fifty-first An. Rpt. New York State Mus., 1897, pp. 327–390, pls. 2, figs. 2*).—The red-breasted sawfly (*Tenthredo rufopectus*) is reported as a new currant pest. The larva of this sawfly, unlike the larva of most sawflies, is recorded as having the habit of boring in the stems of currants and of being found in company with the currant-stem girdler in such situations. A brief account is given of the life history and habit of the insect so far as known and of its distribution. As to remedies, "the wilted tips should be watched for in the early spring, and as soon as seen should be cut off a little below the place of injury. If the attack should escape attention till some time after the dropping of the

tips, the cutting should be made a few inches farther down, and beyond the burrow of the larva."

Brief notes are given of the habits of the white-horned Urocerus (*U. albicornis*). The insect was observed depositing its eggs upon the surface of some freshly sawed spruce lumber. It is stated that this species is rather rare in New York; and as it ordinarily deposits its eggs in dead rather than living timber, no great danger is expected to result from it. A systematic table is given for the separation of the various species of Urocerus found in the State of New York.

The author records some notes on the eggs, larval stages, pupal and adult form of the imperial moth. Its distribution is given for the State of New York. As to its natural enemies, it is said to be exceptionally free, no parasites having been recorded for it, though in one instance it is said to have been attacked by house ants.

A popular account is given of the tarnished plant bug (*Lygus pratensis*). It is recorded that it was unusually destructive to young peach trees in New York through its habit of sucking the juices from the developing buds, and thereby stunting the growth of the trees. As remedies, the author suggests the burning of weeds and rubbish which might serve as a shelter for the insects. When they occur in large numbers, they may perhaps be best captured by jarring into a large net.

The author gives brief notes upon the following insects: Clover-hay caterpillar (*Pyralis costalis*), clover-seed midge (*Cecidomyia leguminicola*), carpet beetle (*Anthrenus scrophulariæ*), oak pruner (*Elaphidion villosum*), hickory borer (*Cyllene pictus*), elm-leaf beetle (*Galerucella luteola*), chinch bug (*Blissus leucopterus*), *Pemphigus populi-transversus*, *Chaitophorus* sp., *Callipterus ulmifolii*, *Drepanosiphum acerifolii*, *Aphis mali*, *Myzus cerasi*, *M. ribis*, *Rhopalosiphum* sp., and *Thrips tabaci*.

The report contains a list of all the publications of the entomologist for the current year, together with such additions as have been made to the State collection, and rather exhaustive bibliographies of most of the insects which are treated in it.

Fourteenth report of the State entomologist on injurious and other insects of the State of New York, E. P. FELT (*Bul. New York State Mus., 5 (1898), No. 23, pp. 151–295, pls. 9, figs. 20*).—The report contains notes on the following insects:

Pale brown Byturus (*Byturus unicolor*) (pp. 158–160).—The beetles are said to have been found in the opening buds of raspberries. According to Fitch the larvæ are found in the berry. The remedies suggested are spraying with arsenites, hand picking, and beating the beetles into pans containing kerosene.

Gooseberry-fruit fly (*Trypeta canadensis*) (pp. 161–163).—The author gives an account of the work of this insect in New York State, with notes on its distribution and life history. For controlling the insect the destruction of the fruit by chickens or artificial means is recommended.

The white-marked tussock moth (*Notolophus leucostigma*) (pp. 163–176,

figs. 4).—The article contains a notice of the unusual ravages of this insect in 1898, together with notes on the life history, habits, natural enemies, and approved artificial remedies, and a synoptic table for the determination of the larvæ of the species of Notolophus.

Apple-tree tent caterpillar (*Clisiocampa americana*) (pp. 177–190, figs. 3).—A résumé is given of the food plants, habits, and distribution of the insect, and an account of the well-known remedies for controlling it.

Forest tent caterpillar (*Clisiocampa disstria*) (pp. 191–201, figs. 2).—The insect is said to have been unusually destructive to forest and fruit trees in New York State for the past 2 years. The food plants and natural enemies of the insect are given and the usual remedies recommended.

Zebra caterpillar (*Mamestra picta*) (pp. 201–207, fig. 1).—This insect is reported as having caused great destruction to timothy hay and oats. A description of the insect is given, together with notes on the natural enemies and the remedies to be recommended.

Xylina antennata (pp. 207–213, fig. 1).—The caterpillar of this insect is recorded as feeding on soft maples, upon which it was very injurious. A good description of the insect is added. The author reared from the insect a parasite tachina fly (*Winthemia 4-pustulata*). As remedies he recommends spraying with the arsenites, or "many of the descending caterpillars can be killed by inclosing the trunks of the infested trees with a low, overhanging barricade and then treating the collected larvæ with hot water."

The author records biological and economic notes on the following insects: *Lecanium tulipiferæ*, *Lepisma domestica*, *Eurypelma hentzii*, *Eriocampoides limacina*, *Silvanus surinamensis*, *Elaphidion villosum*, *Galerucella luteola*, *G. cavicollis*, an elm-leaf miner, *Lecanium armeniacum*, *L. cerasifex*, and the San José scale.

Under the caption "Hints about insecticides," the author gives a general account of the substances used for destroying insects and the rationale of spraying.

The report is supplemented with a list of the publications of the entomologist for the year and an exhaustive index.

Report of the entomologist, A. D. HOPKINS (*West Virginia Sta. Rpt. 1897, pp. 42–57*).—The special lines of work carried on by the author are reviewed, and attention is called to certain of the more important features. Special study was made of the scolytid family of beetles, which family contains the most destructive and dangerous enemies of forest and shade trees, as well as of fruit trees, and one of the worst enemies of the red clover. The collection of these insects made under the author's supervision is said to be one of the most complete in existence.

The series of experiments begun in 1895 to determine the best time to fell timber have been continued and some remarkable results have been obtained, but the author states that in order to verify them and

arrive at definite conclusions they must be continued for some time to come.

A general study of forest conditions and life zones has been begun; and a preliminary report is made of observations on the influence of altitude on the distribution of plant and animal life.

Brief notes are given on investigations made to determine and establish varieties of timothy and red clover and miscellaneous work in investigating the San José scale, inspection of nurseries, the army worm, a parasite of the rose aphis, the maple-twig borer, etc.

Preliminary report upon the insect enemies of tobacco in Florida, A. L. QUAINTANCE (*Florida Sta. Bul. 48, pp. 150–188, figs. 16*).—The bulletin treats of the following insects which are injurious to tobacco:

The horn worm or tobacco worm (Protoparce celeus and P. carolina).—Of these two insects the latter is said to be far more abundant than the former in Florida. The eggs are usually laid on the under surface of the leaves and hatch in about 3 days. The larva requires 3 weeks to attain its full growth. A description is given of the various stages of the insect.

As to treatment the author recommends hand picking, and gives a long account of the use of Paris green in controlling this insect. With regard to the danger from the use of Paris green on tobacco he says: "It will probably be on the side of caution to use weak mixtures of Paris green, as 1 lb. to 160 gal. of water. If this is applied properly and at the right time, when the worms are young, it will be sufficiently strong to kill them." If properly used, there should be no bad result from the use of Paris green on tobacco. Arsenate of lead is also recommended to be used in the form of a powder to be applied by an ordinary powder gun. Another remedy mentioned, which is said to be very effective, consists in pouring a small quantity of a poisonous mixture containing molasses into the flowers of the jimson weed, which are much frequented by these insects. The adult insects will thus be destroyed.

Among the natural enemies of the tobacco worm the author mentions a tachina fly (*Sturmia* sp.), *Apanteles congregatus*, and a brown wasp (*Polistes bellicosus*).

The suck fly (Dicyphus minimus).—This insect, which was first noticed in Florida in the year 1898, is said to be perhaps the most injurious insect to tobacco in the State. The suck fly damages the tobacco by sucking the juices from the leaves. The eggs are deposited in the tissue of the leaves and hatch in about 4 days. A description is given of the nymph and adult stages of the insect. The best remedy, in the author's opinion, is a strong decoction of tobacco. Whale-oil soap was tried, without good results. Kerosene emulsion and pyrethrum were found to be rather effective.

Cigarette beetle (Lasioderma sericorne).—This insect is recorded as being a very serious pest of stored tobacco in Florida and is said to attack other materials, such as pepper, ginger, rhubarb, and upholstery,

as well as dried plants. The best remedy is said to be bisulphid of carbon in closed boxes. A brief description of the different stages of the insect is given.

The tobacco-leaf miner (*Gelechia picipelis*).—The larva of this moth injures tobacco leaves by mining or eating out patches of the leaf substance, thus rendering the leaves unfit for wrappers. The life cycle of the insect is said to require not longer than 20 days, which makes it possible that several broods should occur in one season. The insect may be kept in check by spraying with Paris green in the manner recommended for the tobacco worms.

Cutworms.—Under this head brief notes are given on the cutworms in the State, with special reference to the species *Agrotis ypsilon.* The treatment recommended for cutworms is the use of bran poisoned with Paris green, in which the Paris green is used at the rate of 1 lb. to every 50 to 75 lbs. of bran.

Grasshoppers or locusts.—Two species of grasshoppers are said to be injurious to tobacco, *Pezzotettix femur-rubrum* and *P. bivittatus.* Paris green is recommended for controlling these insects.

Bud worms (*Heliothis* sp.).—The common bollworm of cotton (*H. armigera*) causes considerable damage to tobacco. The eggs are deposited in the buds and the larvæ when hatched feed upon the young unfolding leaves. The remedy which has been found to be effective is the sprinkling of poisoned cornmeal into the bud of the tobacco plant.

The chinch bug, F. M. WEBSTER (*U. S. Dept. Agr., Division of Entomology Bul. 15, n. ser., pp. 82, figs. 19*).—The chinch bug is recorded as being distributed from St. Vincent and Granada, West Indies, into Lower California, on the west coast, to Cape Breton, on the east. It covers pretty largely the whole eastern portion of the United States as far west as Colorado and New Mexico. West of this line it is found only in isolated areas in California. The author maintains that the evidence which he has collected shows that the chinch bug hibernates only in the adult stage. Pupæ and undeveloped larval forms are found in late fall, but there is no evidence that these pass the winter. A favorite place of hibernation of the chinch bug is said to be in stools of the various grasses. Along the Atlantic coast chinch bugs may be found in the spring in great numbers in the stools of several maritime grasses, and in the interior the insects hibernate preferably in the matted blue grass, stools of timothy, and even under sticks and rubbish. Ordinarily about three migrations of the chinch bug may be observed annually—one in May, when the adults which have wintered over move away to new feeding grounds, one in midsummer, and one in the fall, during the so-called Indian summer. These latter two hibernations, however, are said to depend upon the food supply, and if the food is abundant they are not observed to take place.

The eggs of the insect are said to be deposited "either about or below the surface of the ground, among the roots of the grass or grain." Ordinarily the female deposits about 500 eggs during a period

of from 10 days to 3 weeks. The author gives technical descriptions of the various immature stages, as well as of the adult.

With regard to the young bugs it is recorded that they are found mostly upon the lower portion of the plants which they attack. They are frequently found congregated in the sheaths of grasses, and often escape observation under those circumstances.

The number of annual generations for the greater part of the United States is two, but in Ohio the author thinks there is only one brood per year.

Attention is called to the fact that the chinch bug is always of a gregarious habit, and the suggestion is made that this indicates an original habit of living in tufts of grass from which the colony migrated.

Among the food plants are mentioned various maritime grasses, broom corn, sorghum, Bermuda grass, blue grass, wheat, rye, barley, corn, and timothy. The author has never witnessed serious attacks upon oats. A list of the various estimates of losses from the chinch bugs is compiled and explained in some detail.

Among the natural checks to multiplication of the chinch bug, meteorological conditions are considered the most potent factors. The adult insects, however, withstand heavy rains and the severe cold weather of winter; but the young, during the early stages, are easily destroyed by wet weather, particularly by severe windstorms. Consequently, devastations caused by the chinch bug in any particular year will depend very much upon the number and character of the rain storms which occur during the time of the early development of the young chinch bugs. During the latter stages of the immature bugs, heavy rain storms are of little avail.

The two best-known parasitic fungi which attack the chinch bug, *Entomophthora aphidis* and *Sporotrichum globuliferum*, are described. It is a well-known fact that both of these fungi cause more destruction to the chinch bug during a wet season than during an exceedingly dry one. Another rather doubtful enemy of the chinch bug is *Bacillus insectorum*. This bacterium also vegetates more luxuriantly during moist weather.

Various experiments in scattering diseased chinch bugs and cultures of the two fungus parasites of the chinch bug are described, and the results of these experiments, which the author made in Ohio, are recorded as very encouraging.

Among the bird enemies of the chinch bug, the quail is said to be the most important. The other bird enemies which are mentioned are the prairie chicken, red-winged blackbird, catbird, brown thrush, meadow lark, and house wren.

"Perhaps the worst insect enemies of the chinch bug are to be found among its comparatively near relatives, the insidious flower bug, *Triphleps insidiosus* Say (*Anthocoris pseudo-chinche* of Fitch's Second Report), and *Milyas cinctus* Fab., the latter being reported by Dr. Thomas as the most efficient of the insect enemies of this pest, while

Dr. Riley found that the former also attacked it. Professor Forbes ascertained by examinations of the contents of the stomach of a ground beetle, *Agonoderus pallipes* Fab., that one-fifth of the total food of this species was composed of chinch bugs. Drs. Shimer and Walsh both claim that lacewing flies (Chrysopa) destroy chinch bugs, and they are doubtless correct."

Among the artificial remedies, the author suggests the burning over of old grass lands and the burning of all rubbish under which the chinch bug might hibernate. Another remedy suggested is that of sowing protective grasses, as decoy crops for the chinch bug, and thoroughly plowing these under when they become infested by the migration of the chinch bug. The well-known coal-tar method was tried and found to be very successful. The author also tried the method of plowing deep furrows and digging post holes at intervals along the inner line of these furrows, into which the chinch bugs fall and are later destroyed. The use of kerosene emulsion as a spray to be applied directly upon the infested crops gave good results and proved itself very effective in destroying the chinch bug, even when used in a weak solution.

The summary of the author's remedial measures is as follows:

"The insects may be destroyed in their places of hibernation by the use of fire. They can, under favorable meteorological conditions, be destroyed in the fields, if present in sufficient abundance during the breeding season, by the use of the fungus *Sporotrichum globuliferum*, if promptly and carefully applied. They can be destroyed while in the act of migrating from one field to another, by tarred barriers or deep furrows supplemented by post holes, and by being buried under the surface of the ground with the plow and harrow; or the latter method can be applied after the bugs have been massed upon plats of some kind of vegetation for which the bugs are known to have a special fondness, which decoys should be so arranged as to either attract the females and induce them to oviposit therein, or they should be arranged with the idea of intercepting an invasion from wheatfields into cornfields, and, by turning these decoys under with a plow and immediately smoothing and packing the surface by harrow and roller, thus destroying them. While in the cornfields they can be destroyed on the plants by applications of kerosene emulsion."

The author believes, from all evidence at hand, that the original home of the chinch bug was in South or Central America, and that the United States has been infested from its original home. He gives a map showing the supposed course of migration of the chinch bug from Central America up the Pacific coast of this country, along the Gulf States, up the Atlantic coast, and directly north through the Mississippi States.

The periodical cicada, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Bul. No. 14, n. ser., pp. 148*).—The general habits and peculiarities of the insect are mentioned in the introduction to the bulletin. The author distinguishes between the 17-year and 13-year broods, and gives an account of the arguments for and against the idea of these two forms being distinct species. All forms, including the dwarf form, are considered as belonging to one species.

The author believes that there was originally but one brood in the United States, but that in consequence of slowly changing geological

and climatic conditions several broods of both the 17-year and 13-year forms have been definitely differentiated in time of appearance and in locality. The validity of 21 broods has been established. Of this number 14 belong to the 17-year race and 7 to the 13-year race. The periodical cicada is shown to be pretty generally distributed over the country east of the Rocky Mountains. A detailed account is given of the exact distribution of each brood and of the years when it has been known to appear, and from these data predictions are made as to future appearances of the different broods. In general the 13-year race is shown to be southern and the 17-year race northern, but no arbitrary boundary line can be established, for small broods of both races extend over the dividing line.

A long and careful account is given of the systematic position and anatomical structure of the cicada. Its musical apparatus and song are described, and the popular tales concerning the so-called sting of the insect are considered. The author gives an elaborate account of the occurrence, nature, and purpose of the cicada cones, of the transformation and emergence of the adult, and of the length of life of the adult. In his account of the habits of the adult insect he says: "They often also appear in greatest number in rather well defined districts within the general range of the brood, or, in other words, are irregular in local distribution. This variation in abundance is due in some cases to differences in the character of the soil, and in other perhaps to varying surface conditions, as of timber growth, etc."

The feeding habits of the adult cicada are described and an account is given of various attempts to use the cicada for food. The author names the plants upon which the insect deposits its eggs, and says that a preference is shown for oak, hickory, and apple. The process of oviposition is described in great detail. "The female," says the author, "deposits the row of eggs on one side as she makes the original cutting in the bark. She then moves back, and, swinging a little to one side, inserts through the same hole the second row of eggs parallel with the first, thus leaving a small bit of undisturbed wood fiber between the two rows of eggs."

The normal period of incubation for the eggs is said to be from 6 to 7 weeks. As soon as the larva becomes free it "begins to run actively about with the quick motions of an ant, but soon goes to the side of the limb, loosens its hold, and deliberately falls to the ground."

The experimental and other proofs of the length of the underground larval and pupal life are enumerated and discussed. Four larval stages and two pupal stages are distinguished and described. The root-feeding habit of the larva is described in some detail. The larvæ are said to occur in greatest number at a depth of from 8 to 18 in. in the soil. The damage caused during the underground life of the insect is considered very slight.

Among the natural enemies of the cicada are mentioned reptiles, quadrupeds, birds, ground beetles, dragon flies, soldier bugs, hogs, and

poultry. Among birds the English sparrow is said to be especially destructive to the cicada. The following insect parasites of the cicada are recorded: A Cecidomyid egg parasite and a number of Hymenopterous egg parasites, and several mites of the genera Oribatella, Oripoda, Oppia, Pediculoides, Tyroglyphus, Iphis, Cheyletus, and Bdella. A few predaceous Hemiptera and the digger wasp (*Megastizus speciosus*) are mentioned as important enemies of the cicada.

As artificial remedies the author recommends the use of nets on small trees to prevent the insects from depositing their eggs. Pyrethrum, applied either as a powder or in water and kerosene emulsion, was found to be an effective remedy when sprayed upon the adult cicada. For destroying the cicada during its underground life, tobacco dust in the soil and bisulphid of carbon are recommended. The author reviews the more important papers on the cicada and gives an extensive bibliography of the subject.

The grapevine flea-beetle, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 157, pp. 189–213, figs. 19*).—The author gives a review of the literature of the subject and a description of the insect in its various stages. Among the food plants of this flea-beetle are mentioned the wild and cultivated grapes, plum trees, the water beech, apple, and quince. No decided preference is shown by the insect for any special variety of grape. The greatest damage is done by the adult beetle in early spring in eating the undeveloped buds and thus preventing the formation of fruit. The adult beetles work upon the young buds only a few days, but when they occur in large numbers this time is usually sufficient to cause great destruction. The eggs are laid from the middle of May to the middle of June. The time of incubation was not determined. It is supposed to be about 3 weeks. The young grubs feed upon the leaves and are usually found upon the upper surface. The pupal stage is passed about an inch or two under the surface of the soil and lasts about a week. The adult beetles then attack the leaves late in the summer in about the same way that the grubs do during the earlier part of the season. The evidence seems to show that there is but one brood of the insect in New York. The insect passes the winter in the adult stage, hiding in grass and under rubbish and in the cracks of bark, and emerges from the hiding places in April and May.

Among its natural enemies are recorded *Podisus modestus* and *Megilla maculata*. Much good may be done by removing and burning all bark, splinters, and rubbish in the vicinity of the vines in the fall, thus destroying the hibernating beetles. In the early spring, when the beetles first emerge, they may be readily jarred into a pan of kerosene or upon sheets saturated with kerosene. The most effective remedy, however, is spraying with Paris green, at the rate of 1 lb. of Paris green to 150 gal. of water for the purpose of destroying the grubs. The grubs may be readily seen as they feed upon the upper surface of the leaves. Paris green may be used as a spray against the adult beetles before the development of the buds, and may then be used in

the proportion of 1 lb. to 75 gal. of water with the addition of a pound of lime.

An extensive bibliography is appended to the bulletin.

The Hessian fly in the United States, H. OSBORN (*U. S. Dept. Agr., Division of Entomology Bul. 16, n. ser., pp. 57, pls. 2, figs. 8, map 1*).—The original home of the Hessian fly is left in doubt, with the suggestion that it probably was the same as that of wheat. The distribution of the insect is practically coextensive with the wheat-producing regions of Europe and America. The author mentions two means of distribution of the Hessian fly; the first and less important is the slight power of flight, while the chief means is transportation in straw containing puparia or flaxseeds. "The introduction into the United States near New York City has as its most probable foundation the straw used as bedding by the Hessian troops landed during 1776 and 1777, and while there is lacking positive evidence that the insect existed at the point of their starting or even of embarkation, the source of straw they might have used and scattered after landing may have been in some infested locality." A careful description is given of the entomological details and of the life history of the insect, including the 3 larval forms and the pupal.

As to the question of the number of broods per year, the author believes that in the northern and eastern part of the country the insect passes through 2 broods per year, but that temperature and moisture conditions have a great influence in retarding or accelerating development. "The Hessian fly presents variations not only in the number of broods, from 1 to possibly 5 or 6, depending upon latitude, but by acceleration or retardation, under conditions peculiar to each year, it may appear earlier or later and in a greater or less number of broods in the same locality. This variation naturally enhances the difficulty of stating life history details with precision and making recommendations as to particular dates on which to adopt measures of control." Certain authorities have recorded the Hessian fly as having been found upon a number of cultivated grasses. The author, however, does not accord accuracy to these observations, but states that "in any deductions relating to the control of the Hessian fly, it may be considered for all practical purposes that the insect lives only on wheat, rye, or barley, and will not perpetuate itself on other plants." An account is given of the different effects on the host plants depending upon whether the attack is made in the spring or fall.

Under the head of the natural enemies of the Hessian fly the author lists a number of primary and secondary parasites as found in this country, and gives a list of parasites as recorded in Russia, England, and France. The primary parasites found in this country are described and figured, and an account is given of their biological relationship. The author gives a history of the introduction by Dr. Riley of the parasite *Entedon epigonus* from Russia, and of the success of its introduction.

Among other natural enemies of the Hessian fly are mentioned nematode worms and thrips.

As to artificial remedies, the author recommends the burning of stubble as soon after the cutting of the grain as possible in case of a moist season. This remedy is not so necessary during a dry season. In certain cases it may be advisable to plow under the stubble. In order that this may be effective the ground should be plowed to a depth of several inches. It is also recommended that all volunteer wheat be destroyed in order that belated individuals may not find a food supply. The author further recommends a rotation of crops such that wheat shall not come 2 years in succession on the same ground, and also that fall wheat should preferably be sowed late rather than at the beginning of the fall season in order to avoid attacks of the Hessian fly upon the young developing wheat. Such remedies as pasturing fall wheat with sheep, rolling the wheat with a heavy roller in the fall, and mowing the young wheat are considered by the author as being of but little avail. It is stated that certain varieties of wheat have been found to be more resistant to the attacks of the Hessian fly than others, and a selection of varieties may be made accordingly.

Of the various insecticides which have been used, none have ever been effectual and none are therefore to be recommended.

A rather complete bibliography of the literature on the Hessian fly is appended to the bulletin, containing 141 titles.

The use of hydrocyanic-acid gas for fumigating greenhouses and cold frames, A. F. WOODS and P. H. DORSETT (*U. S. Dept. Agr., Division of Entomology Circ. 37, 2. ser., pp. 10, figs. 3*).—Greenhouse plants were less injured by a short exposure to a large amount of gas than by a long exposure to a small amount of the gas, and at the same time the insects were more thoroughly destroyed by the large amount of gas for a short time. It was found that fumigation after sundown with the temperature as low as practicable gave the best results. For ferns 0.075 gm. of 98 per cent cyanid of potash was used for each cubic foot to be fumigated. The ferns were infested with Chionaspis. All the insects were destroyed. Coleus and other related plants were fumigated at the rate of 0.1 gm. of 98 per cent cyanid of potash per cubic foot of space. Double English violets were fumigated at the rate of 0.15 gm. of 98 per cent cyanid of potash for each cubic foot of space. Roses were found to be especially sensitive and many of them were more or less injured in all of the experiments. Carnations were found to endure 0.1 gm. of cyanid of potash per cubic foot for 15 minutes. Grapes under glass endured 0.09 gm. per cubic foot. Tomatoes withstood 1 oz. of pure cyanid of potash for each 1,000 cu. ft. Careful directions are given for obtaining the cubic space of greenhouses and for calculating the necessary amount of cyanid to be used in each case.

The materials to be used are 98 per cent cyanid of potash and commercial sulphuric acid. Earthen jars 1½ or 2 gal. in capacity and of

small diameter are recommended as vessels in which to produce the gas. There should be 1 jar for each 50 ft. in length of an ordinary greenhouse. The cyanid of potash is weighed out and inclosed in paper bags, which may be suspended by a string directly over the jars and can be lowered from the outside of the greenhouse. An amount of water should be poured into each jar equal to the amount of potassium cyanid in the bag, or about ½ pt. of water to each 8 oz. of cyanid. Sulphuric acid should then be added until the water steams. The house should be tightly closed. The bags are then lowered into the jars for the necessary length of time. The greenhouse should be ventilated for at least half an hour before entering.

Report to the Royal Ministry of Agriculture concerning work of the State entomological department for the year 1898, S. LAMPA (*Ent. Tidskr., 20 (1899), No. 1, pp. 70*).—Contains notes on a large number of economic insects and their injuries in Sweden, including *Argyresthia conjugella, Cecidomyia destructor*, and *C. tritici*.

Insects collected on Mount Fugi, M. MATSUMURA (*Annotationes Zool. Japonenses, 2 (1898), pt. 4, pp. 113–124*).—Gives a considerable list of insects which are noted as occurring in zones at different elevations on the mountain.

Acclimatization of beneficial insects (*Rov. Lapok, 6 (1899), No. 4, pp. 88*).—*Vedalia cardinalis* from California has been successfully introduced into the Sandwich Islands.

A serviceable insectary, F. M. WEBSTER (*Canad. Ent., 31 (1899), No. 4, pp. 73–76*).—Describes the insectary used in the Ohio Station.

The common blue tick of Cape Colony and its relationship to the red water ticks of North America and Australia, C. FULLER (*Agr. Jour. Cape Good Hope, 14 (1899), No. 6, pp. 363–369*).—Contains an analytical table of the species of Rhipicephalus. The American *Boophilus bovis* is called *R. annulatus* and the local blue tick of the colony is called *R. decoloratus*. The latter, like the American species, carries red water from animal to animal.

Codling moth, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 14 (1899), No. 5, pp. 285–287*).—Reminds fruit growers of the dangers from this insect in the colony.

A new rival of the codling moth, E. REUTER (*Ent. Tidskr., 20 (1899), No. 1, pp. 71–76*).—*Argyresthia conjugella* is described, with an account of its life history and distribution and its injuries to the apple.

Phylloxera, L. DE SISTERNES (*Bol. Agr. Min. Ind., Mexico, 8 (1898), No. 4, pp. 11–39*).—The article contains an account of the life history, habits, and injuries resulting from the phylloxera, together with a description of the insect in its various stages. As remedies the author suggests pulling out the weak vines, flooding the vineyard, the use of insecticides, destruction of winter eggs, rearing its insect enemies, planting in sandy soil, and the use of American varieties.

Some notes on the grape-cane gall maker (Ampeloglypter sesostris), F. M. WEBSTER (*Ent. News, 10 (1899), No. 3, pp. 53–55, pl. 1*).—Notes on the habits of this insect in Gypsum, Ohio. Two parasites reared *Catolaccus tyloderma* and *Myiophasia ænea*.

Pieris brassicæ (*Jour. Bd. Agr. [London], 5 (1899), No. 4, pp. 459–463*).—Gives the life history and remedies for controlling this insect.

The cottony cushion scale, H. A. GOSSARD (*West Hillsboro Press, 5 (1899), No. 37*).—A popular article.

Seasonal dimorphism in Lepidoptera, ROLAND TRIMEN (*Nature, 59 (1899), No. 1537, pp. 568–573*).—The author considers this phenomenon in a large number of species, and suggests the establishment of zoological stations for studying the subject.

Investigations on the accelerated development of hibernating butterfly pupæ, H. GUCKLER (*Illus. Ztschr. Ent., 4 (1899), No. 7, pp. 103–105, pl. 1*).—Relates experi-

ments which show the effect of increased temperature in hastening the development of butterfly chrysalids.

Operations with a locust fungus (*Agr. Jour. Cape Good Hope, 14 (1899), No. 5, pp. 290–296*).—Reports the apparently successful use of pure cultures of a fungus for the destruction of locusts. Although not here stated, the fungus is probably *Empusa grillæ*.

FOODS—ANIMAL PRODUCTION.

The constituents of the seed of Pinus cembra, E. SCHULZE and N. RONGGER (*Landw. Vers. Stat., 51 (1898), No. 2–3, pp. 189–201*).—The authors made an extended microscopical and chemical study of the seeds of *Pinus cembra*. These seeds are edible and are known as "Zirbel" nuts or "Arve." Analyses of the seeds include the study of the whole seed, the shell, and kernel. Owing to the large amount of fat present, it was found necessary to extract a considerable portion of the fat before the final grinding for analysis.

The shell constitutes 62.6 per cent and the kernel 37.4 per cent of the total dry matter of the seeds. The dry matter of the shell had the following percentage composition: Protein 0.84, fat 1.18, nitrogen-free extract and crude fiber 98.18, ash 0.80. The dry matter of the kernel had the following composition: Protein 17.24, glycerids of free fatty acids 49.26, lecithin 0.99, starch 7.43, water soluble nitrogen-free substances 16.84, crude fiber 1.19, ash 3.5.

The authors state that the ash is said to contain much phosphoric acid, and is undoubtedly rich in alkali. More than 80 per cent of the total ash was found in an aqueous extract of the seeds.

Vinegar adulteration and the extent to which it exists in the samples for sale in North Carolina, W. A. WITHERS and J. A. BIZZELL (*North Carolina Sta. Bul. 153, pp. 25–32*).—Twenty samples of vinegar sold in the State were examined. Thirteen compared favorably with cider vinegar as far as the amount of acetic acid was concerned and 5 were too weak in acid. The amounts of total solids and ash indicate that only one sample was pure cider vinegar. One of the samples was sold as grape vinegar; 2 samples were apparently diluted with water; 17 appeared to be spirit vinegar, with the addition of organic coloring matter. The so-called grape vinegar was spirit vinegar with coloring matter. Ninety-five per cent of the samples analyzed were adulterated. The authors recommend "(1) that all vinegars shall contain not less than 4 per cent by weight of absolute acetic acid, and must contain no lead, copper, mineral acids, or artificial coloring matter; (2) that all vinegars must be branded with the name of the fruit or substance from which they are made, together with the name and address of the manufacturer; (3) cider vinegar shall not contain less than $1\frac{3}{4}$ per cent by weight of cider-vinegar solids."

The North Carolina act to prevent the sale of adulterated or misbranded foods is quoted.

Concentrated feed stuffs, J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Bul. 56, pp. 24*).—The authors report the examination of concentrated feeding stuffs in accordance with the law in Massachusetts.

The feeding stuffs examined were cotton-seed meal, linseed meal, gluten meals, gluten feed, wheat bran, wheat middlings, Red dog, mixed feeds, miscellaneous concentrated feeds, corn meal, oat feeds, corn and oat feeds, corn, oat, and barley feeds, hominy feeds, miscellaneous starchy feeding stuffs, and poultry foods. Among the suggestions drawn from the examination were the following:

"Farmers are especially cautioned against adulterated cotton-seed meal. Samples of this substance were found in a large number of towns, especially in northeastern Massachusetts, during the spring months. Sea-island cotton seed, so called, is also very much inferior to the genuine material. . . . It is . . . only one-half as valuable as the prime article. It is evidently prepared by grinding the black hulls quite fine and mixing them with the yellow meal. The resulting product is as a rule of a darker yellow than the pure meal. Samples of adulterated meal have also been found that were bright yellow. This meal had either been artificially colored or mixed with some inferior substance other than hulls. We urge purchasers to buy only the guaranteed article, and to absolutely refuse the unbranded meal. Pure cotton-seed meal is one of the very cheapest concentrated feed stuffs. Linseed meals, branded gluten meals, and gluten feeds examined show no adulterations. Wheat bran, middlings, and, with a few exceptions, mixed feeds, have not been found to contain any foreign admixtures. Heilman's mixed feed was found to be of very poor quality. It contained a large amount of woody material, of very little feeding value. Several unmarked mixed feeds were similarly adulterated. The Lexington mixed feed showed several per cent less protein than the average. Many unbranded oat feeds have been found to contain as high as 65 per cent of hulls and only from 5 to 7 per cent of protein. Such foods prove costly at prices asked for them. See more extended remarks under analyses of these feeds."

Dried grains as a substitute for hay, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), pt. 4, pp. 768–774*).—A test was made with steers at the Woburn Farm to learn how far dried brewers' grains could advantageously replace hay in a time of scarcity. Sixteen Shorthorn 3-year-old steers were divided into 2 lots of 8 each. Four animals of each lot were fed in stalls, 2 in sheds, and 2 in open yards. The test began December 22, 1897, and was divided into two periods of 40 and 70 days, respectively. During the first period lot 1 was fed dried brewers' grains *ad libitum*, and lot 2 cut hay *ad libitum*. In addition each lot at the beginning of the test was fed 3 lbs. decorticated cotton-seed cake, 3 lbs. of maize meal, and 28 lbs. of Swedish turnips. After about 6 weeks the grains were each increased to 4 lbs. and the Swedish turnips to 35 lbs. After a time mangel-wurzels were substituted for Swedish turnips, and in the latter half of the period linseed cake was added to the ration. During the test lot 1 consumed 4,178 lbs. dried brewers' grains and the average daily gain per steer was 2.18 lbs. Lot 2 consumed 5,820 lbs. of hay, the average daily gain per steer being 3.05 lbs. The cost of the gain is discussed and it appeared that the more economical gains were made with hay. From this test, "as also from general observations throughout the experimental period, it was shown that in steer feeding it does not do to replace hay entirely by dried grains." The test was continued with the same steers to see whether dried brewers' grains might not to advantage replace hay in part. The steers in lot 1 were fed 5 lbs.

of hay chaff daily and as much dried brewers' grains as they would eat, in addition to the same ration as before. It was found that this method of feeding did not materially diminish the amount of dried brewers' grains consumed. Lot 2 was fed the same ration as during the first period. As the test continued it was observed that with lot 1 there was a tendency to consume less coarse fodder, but this was also observed with the lot fed hay. In the 71 days of the second period the steers in lot 1 made an average daily gain of 2.60 lbs., those in lot 2, 2.20 lbs. The gain is discussed at some length from a financial standpoint.

"It would appear that while dried grains, used along with a small quantity of hay chaff, can replace hay quite well as a food for bullocks and give a larger increase of live weight, yet at the respective prices quoted for dried grains and hay [$21.50 and $15.83 per long ton (2,240 lbs.), respectively, including transportation and cutting or chafing] and carcass meat [7 cts. per pound], there is very little monetary difference whether dried grains are used along with the small quantity of hay chaff, or whether hay chaff is used alone. Further, from the earlier part of the experiment it is clear that dried grains can not be made to replace hay entirely for bullock feeding, but that hay or similar food must be used along with them. Also that the same weight of fibrous food will be required whether hay be used alone or as a supplement to dried grains."

The maintenance ration of cattle, H. P. ARMSBY (*Pennsylvania Sta. Bul. 42, pp. 188, pls. 18*).—The author reports a series of experiments with steers, extending from 1892 to 1897, to learn the amount of food required for maintenance. In all cases the feeding was continued for long periods. During a portion of the period the digestibility of the ration was determined as well as the balance of income and outgo of nitrogen. Records were kept of the gains or losses in live weight and in many cases of the amount of water consumed, and of variations of the temperature of the stalls in which the steers were kept. In some of the tests the results were calculated in overlapping 10-day periods, since the author believed that it was thus possible to eliminate errors. In the several experiments the gain or loss of protein and fat was estimated as well as the fuel value of the ingesta and egesta (in the later experiment fuel values were determined), due allowance being made for the estimated energy of the urine and the methan. In all the tests 3 steers were used. They were apparently grade Shorthorns and in 1892 were past two years old. They weighed at the beginning of the experiments 427.7 kg., 457.9 kg., and 407.3 kg., respectively.

The first experiment began December 1, 1892, and covered 52 days. Previous to the test the steers had been fed nothing but hay. During the test the ration consisted of 4.563 kg. of timothy hay containing a little clover. From January 15 to 21 the digestibility of the ration and the income and outgo of nitrogen was determined.

The second test began January 22, 1898, and covered 71 days. The ration in the first test having proved insufficient, the amount of timothy hay was increased to 5.44 kg. The special digestion and metabolism experiment began Febuary 19 and covered 7 days.

The third experiment began November 16, 1893, and covered 51 days. In this experiment the ration consisted of timothy hay and corn meal,

the amount fed at the beginning being 5.444 kg. of hay and 0.455 kg. of corn meal. The amount of hay was gradually decreased and the corn meal increased to November 21 until the amounts fed were 2.948 kg. of timothy hay and 1.474 kg. of corn meal, this ration being continued throughout the experiment except in the case of a few days when steer No. 3 was ill and received different food. The special digestion and metabolism experiment began December 16 and covered 7 days.

The fourth experiment began January 6, 1894, and covered 70 days. In this test new-process linseed meal was gradually substituted for corn meal until 1.678 kg. was fed. The amount of hay was the same as in previous test. Steer No. 3 showed a tendency to decrease in weight, and his ration was therefore increased to 3.629 kg. of hay and 1.814 kg. of linseed meal. The special digestion metabolism experiment began February 21 and covered 7 days.

The fifth experiment began March 17, 1894, and closed April 21. The primary object of this test was to learn the digestibility of the so-called "cotton-seed feed," which it was claimed consisted of cotton-seed meal and hulls 1:5. The special digestion and metabolism experiment began April 15 and ended April 21. This test has been reported in a previous publication (E. S. R., 6, p. 1014).

The sixth experiment was made in 1894–95. The steers had been in pasture during the spring and early summer. The latter part of July they were put on a ration of 5.44 kg. of timothy hay. August 17 this was replaced by the same quantity of long hay, consisting chiefly of timothy with some admixture of blue grass. After a few days this was replaced by the same amount of cut hay such as was used during the experiment proper. From July 22 until the beginning of the experiment proper the weight of the steers and the amount of water consumed was recorded. The experiment proper began November 28 and extended over 106 days. At the beginning of the experiment the daily ration consisted of 6.35 kg. of mixed clover and timothy hay. After December 13 this was replaced by the same amount of cut timothy hay. In this test the steers were kept in special stalls, which are described in detail. They were essentially the same as the so-called Bidwell stall. The digestibility of dry matter and nitrogen was determined throughout the whole experimental period, with the exception of the interval from February 15 to March 6. The special digestion experiment began January 12 and closed January 18. The nitrogen in the urine was determined throughout the whole test.

The seventh experiment, which covered 41 days, began March 14, 1895. Starch was gradually substituted for a part of the hay until the ration consisted of 5.2 kg. of hay and 0.8 kg. of starch. From March 28 until the close of the test the digestibility of the dry matter and nitrogen was determined as well as the nitrogen in the urine. The special digestion period covered 7 days, beginning April 13.

The eighth experiment began December 27, 1896, and covered 96 days. Wheat, straw, corn meal, and linseed meal were gradually substituted for the previous ration until on January 15, steer No. 1 was fed 2 kg. of wheat straw, 2.5 kg. of corn meal, and 0.5 kg. of linseed meal. Steers Nos. 2 and 3 were fed the same amounts of wheat straw and linseed meal and 2.75 kg. of corn meal. These rations were continued throughout the test. The digestibility of the ration was determined from January 29 to February 11, and from March 12 to 28.

All of these tests are discussed in detail. The digestibility of the different rations and the balance of income and outgo of nitrogen are shown in the following table:

Coefficients of digestibility and income and outgo of nitrogen in experiments with steers.

	Dry matter.	Proteids.	Ether extract.	Nitrogen-free extract.	Crude fiber.	Energy.	Nitrogen. In food.	In urine.	In feces.	Gain (+) or loss (—)
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Gm.	Gm.	Gm.	Gm.
Experiment 1 (timothy hay):										
Steer No. 1	57.66	44.45	51.12	65.68	51.16	54.81	41.75	22.63	21.63	— 2.51
Steer No. 2	55.08	41.98	50.00	63.38	51.94	52.30	41.75	19.57	22.57	— 0.39
Steer No. 3	52.71	43.63	51.12	59.25	46.31	49.69	41.75	20.83	22.00	— 1.08
Experiment 2 (timothy hay):										
Steer No. 1	50.59	45.61	44.00	57.97	42.02	47.20	60.92	28.43	30.73	+ 1.76
Steer No. 2	58.00	51.56	53.00	64.90	51.25	55.30	60.92	29.37	27.32	+ 4.23
Steer No. 3	50.30	47.31	46.00	55.02	44.82	46.93	60.92	26.63	29.67	+ 4.62
Experiment 3 (timothy hay and corn meal):										
Steer No. 1	51.22	54.60	61.11	71.75	4.97	47.52	51.67	28.95	22.94	— 0.22
Steer No. 2	57.88	58.73	64.84	73.47	24.47	55.31	51.67	28.32	20.74	+ 2.61
Experiment 4 (timothy hay and linseed meal):										
Steer No. 1	34.44	67.97	48.35	49.29	(?)	32.00	126.33	78.18	38.01	+10.14
Steer No. 2	42.11	68.11	56.04	54.06	1.31	38.90	126.33	69.04	37.95	+19.34
Steer No. 3	45.35	69.20	61.68	53.74	14.04	44.11	126.33	71.26	40.97	+29.03
Experiment 5 (cotton-seed feed):										
Steer No. 1	42.19	....	82.86	53.36	28.30	40.83	85.63	25.96	55.16	+ 4.51
Steer No. 2	44.98	....	85.72	58.55	33.19	44.70	85.63	25.79	57.92	+ 1.92
Steer No. 3	42.72	....	84.00	50.09	31.92	42.66	110.09	33.05	64.94	+12.10
Experiment 6 (timothy hay):										
Steer No. 1	58.52	53.95	45.88	61.34	57.95	55.50	83.47	42.33	36.47	+ 4.67
Steer No. 2	59.31	54.80	50.77	62.58	58.52	56.18	83.47	41.21	35.79	+ 6.47
Steer No. 3	57.51	54.58	51.57	60.45	56.38	54.88	83.47	44.86	35.96	+ 2.65
Experiment 7 (timothy hay and starch):										
Steer No. 1	64.02	44.77	43.31	72.29	55.06	61.25	57.80	24.48	27.63	+ 5.68
Steer No. 2	63.96	41.18	51.83	72.20	54.82	60.84	57.80	24.40	29.42	+ 3.98
Steer No. 3	62.01	42.09	46.45	70.93	50.56	59.16	57.80	24.69	28.96	+ 4.15
Experiment 8 (wheat, straw, corn meal and linseed meal):										
Period I—										
Steer No. 1	68.57	65.85	84.34	77.24	41.83	68.80	79.68	50.09	24.00	+ 4.59
Steer No. 2	72.84	67.92	84.21	80.77	47.84	72.61	82.61	57.85	23.60	+ 1.16
Steer No. 3	66.00	62.70	84.32	75.42	33.86	65.97	82.61	55.09	27.41	+ 0.11
Period II—										
Steer No. 1	67.81	61.80	80.26	77.52	39.46	68.06	78.80	56.13	26.74	— 4.07
Steer No. 2	73.38	64.25	82.54	81.57	48.68	72.61	82.73	58.00	26.28	— 1.55
Steer No. 3	68.54	60.88	83.25	78.00	38.35	68.70	82.73	58.70	28.75	— 4.73
Average of all coefficients: *a*										
Steer No. 1	58.48	52.74	61.68	66.49	45.11	56.64	....	....	....	....
Steer No. 2	61.08	53.62	65.44	69.14	49.46	59.22	....	....	....	....
Steer No. 3	57.11	51.87	63.81	64.17	43.17	55.43	....	....	....	....

a Excluding experiments 3 and 4.

As previously stated, rations were selected which it was believed were just sufficient for maintenance, their value for this purpose being judged by variations in live weight and gain or loss of nitrogen. The author compares his results with those of other investigators, and concludes that the average steer weighing 500 kg. when fed a ration consisting only or mainly of coarse fodder requires for maintenance 13,000 calories of available energy at a stable temperature of 50 to 60° F. after making a deduction for the loss of energy in the form of methan. The amount of protein required is also discussed.

"It would appear that with a nutritive ratio of about 1:11, a minimum of about 300 gm. of proteids per day and 500 kg. live weight is required for maintenance, and that any material diminution of this amount will result in a loss from the body. Furthermore, however, it would appear that if the nutritive ratio be made wider, this amount of proteids may be very materially reduced, at least for a time, without leading to a loss of nitrogen by the body or to any recognizable injurious consequences.

"Finally, it may not be superfluous to point out that the term proteids as here employed, following the common usages, is a conventional term. Neither the variations in the percentage of nitrogen in the vegetable proteids nor the presence of nitrogenous metabolic products in the feces has been taken account of. As regards the former, our knowledge of the composition of the proteids of coarse fodders is insufficient to enable us to substitute any other factor for the conventional 6.25, so that only in one experiment (No. 8) was there any approximately sufficient basis for recalculation of the analytical results.

"The metabolic products in the feces can be determined with some degree of accuracy, but inasmuch as they are waste products it makes little practical difference in any single experiment of this sort whether we correct the apparent digestibility of the proteids for them in order to obtain the true percentage digestibility and say that the ration contained, e. g., 325 gm. of digestible proteids, of which 25 gm. was required to make good the excretion of metabolic products in the feces, or whether we subtract the total proteids of the feces from those of the food and say that the ration contained the net amount of 300 gm. of proteids available to the body.

"In the case of widely different rations, of course, the proportion of metabolic products may vary and thus distort the comparison, and undoubtedly their determination is desirable, but it is not believed that the failure to take account of them in these experiments seriously affects the value of the results as regards proteids, while, as already pointed out, the results of the energy of the rations are independent of it."

The relative value of coarse fodder and grain is also spoken of at length. The article contains an extended review of the literature of the subject, and the author's results are compared with those of other investigators.

Experiments on the value of meadow hay, W. VON KNIERIEM (*Landw. Jahrb., 27 (1898), No. 3–4, pp. 521–565*).—Investigations conducted at the Peterhof Experimental Farm are reported. These investigations extended over several years and represent the work of a number of individuals. Experiments with rabbits are reported on the digestibility of white and red clover, kidney vetch, spring vetch, timothy, perennial rye grass, orchard grass, and water avens, and with sheep and cows on the digestibility of mixed grasses, clover, and sour grass.

The relation of the different parts of orchard grass and timothy of luxuriant growth and stunted growth was studied. Measurements of the growth of yellow rocket (*Barbarea vulgaris*) and studies of the composition, including fertilizer constituents, of the stem and leaf were also made.

In addition to digestion experiments with cows the comparative value of clover hay and sour grass hay for the production of milk was studied. Feeding sour grass hay diminished the milk yield, while clover hay increased it.

The relative digestibility of foods by different animals is discussed. The majority of feeding stuffs are said to be about equally well digested by different ruminants. When, however, the feeding stuff contains a small amount of nutritive material it is better utilized by cows than by sheep. The results obtained with rabbits are believed to be comparable with those obtained with the larger animals.

Investigations on the value of different concentrated feeding stuffs, W. VON KNIERIEM (*Landw. Jahrb., 27 (1898), No. 3-4, pp. 566-630*).—These experiments, which extend over a number of years, were conducted by different investigators at the Peterhof Experimental Farm. Experiments are reported with rabbits, sheep, and horses on the digestibility of cocoanut cake, hemp-seed cake, linseed cake, sunflower-seed cake, rape-seed cake, meadow hay, and a number of mixed rations. In some cases the digestibility of the concentrated feeding stuff was calculated by deducting from the digestibility of the mixed ration the calculated digestibility of the other feeding stuffs, and in others it was determined by changing the ratio of the foods and calculating the digestibility algebraically on the basis of the differences observed. The results obtained by the two methods of calculation are compared.

In a number of the experiments the balance of income and outgo of nitrogen was also determined.

Tests of the effect of cocoanut cake and linseed cake on the yield and composition of milk were also reported with 2 cows. The cocoanut cake increased the milk yield 16 per cent, and the linseed cake 12 per cent. Notwithstanding the fact that the fat in the two sorts of cake possessed such different properties, the butter made when these cakes were fed was not materially changed as regards melting point, cooling point, or content of nonvolatile acids. As regards the volatile acids, so great irregularities were observed that no deductions could be drawn.

A test of the effect of palm-nut cake on the yield and composition of milk was also made. It was fed with clover hay. As compared with periods when clover hay was fed alone, palm-nut cake increased the production of milk about 17 per cent. The fat content of the milk was also increased. Butter made from milk obtained in the different periods was compared. The saponification number of the butter was increased when palm-nut cake was fed.

In this and the preceding article, a large number of investigations by other observers are cited, often in considerable detail.

The relative values of different fibrous foods for sheep, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 9 (1898), pt. 4, pp. 774–786*).—A test was made at Woburn Farms to ascertain the most satisfactory coarse fodder for sheep in addition to roots. Sixty Hampshire Down lambs, showing a little Oxford blood, were divided into 4 lots of 15 each. Lot 1 was fed cut (or chaffed) oat straw, lot 2 cut meadow hay, lot 3 cut meadow hay and cut oat straw 1:1, and lot 4 dried brewers' grains. In addition the sheep were given Swedish turnips. These feeding stuffs were supplied *ad libitum*. All the lots were also given the same amount of linseed cake. The test began November 29, 1897. The financial statement is based on linseed cake at $42.63, dried brewers' grains at $21.50, oat straw at $7.86, meadow hay at $15.83, and Swedish turnips at $1.75 per long ton (2,240 lbs.). These values include cutting or chaffing and transportation. March 7, 6 sheep from each pen were sold and slaughtered; March 28, 5 sheep from lots 1, 3, and 4, and 4 from lot 2 (one sheep in this lot had died) were sold and slaughtered. The remainder of the sheep were disposed of April 20. Considering the test as a whole, the average daily gain per head of lot 1 was 0.405 lb.; of lot 2, 0.425 lb.; of lot 3, 0.433 lb., and of lot 4, 0.409 lb. The percentage of live weight to carcass in the 4 lots was 51.84, 51.68, 52.49, and 52.56, respectively. The greatest profit was realized with lot 3. The tests are reported and discussed in detail:

"In making these comparisons it has to be borne in mind that the money values put upon the roots, the oat-straw chaff, and the hay chaff are only estimates, and these may well be reduced in particular cases, seeing that the foods are home-produced, whereas in the case of the dried grains the actual prices put down had to be paid.

"It was abundantly clear, however, that the sheep did exceedingly well on the dried grains and liked the food greatly; also that hay could be entirely replaced by dried grains, a result different from that obtained in a similar experiment on bullocks (see p. 1078). But it can not be said that the feeding with dried grains was more profitable than with hay chaff, while a mixture of hay chaff and oat-straw chaff, half and half, proved to be the most economical feeding.

"The question of the profitable employment of dried grains for fattening sheep must clearly depend upon whether the price of the grains greatly exceeds that of hay or not."

The influence of manures on the production of mutton, W. SOMERVILLE (*Jour. Bd. Agr. [London], 5 (1898), No. 3, pp. 300–314*).—A test was made to compare different methods of fertilizing poor pasture land as shown by the gains made by sheep pastured on the different plats fertilized, the results being compared with the yield of hay on the different plats. The tests were begun in 1897 and covered 2 years. The fertilizers were applied in 1897 only. There were 10 plats of 3 acres each and in each plat a subplat of one-twentieth of an acre was fenced off. Sheep were pastured on the large plats and the hay on the subplats was harvested. The fertilizers were so regulated that 200 lbs. per acre of phosphoric acid was applied to plat 3; 100 lbs. per acre to

plats 4, 5, 7, 8, 9, and 10; 50 lbs. per acre of potash to plat 7; and 20 lbs. of nitrogen per acre to plat 9, and 17.2 lbs to plat 10. Plat 1 received no direct manuring; the sheep grazing on it, however, were fed ¾ lb. per head daily of decorticated cotton-seed cake. About 6 cwt. per acre of ground cotton-seed cake was applied to subplat 1. At the end of 3 years the pastured area of plat 1 will have received about the same amount of nitrogen in the form of manurial residue as was added in the form of crushed cake to the subplat. Plat 6 was not fertilized and served as a control.

Beginning June 27, 1897, 8 crossbred sheep were pastured for 16 weeks on each of the plats. In 1898 the sheep were turned into pasture May 16. Six sheep were placed on plat 6; 8 on plats 2, 4, 5, 7, 8, 9, and 10, and 10 on plats 1 and 3. Six weeks later 1 more sheep was added to plats 1 and 7 and 2 more to plats 3, 9, and 10. The grazing season terminated October 3. The sheep pastured were slaughtered and the weight of carcass and percentage of mutton determined.

The average results of the tests, which are discussed in detail, are shown in the following table, which gives the percentage of increase of hay and mutton produced on the different plats as compared with plat 6 taken as a unit. The average live weight, the average dressed weight, and percentage of mutton of the lots pastured on the different plats are also shown.

Average results of different methods of manuring pasture as shown by production of hay and mutton.

Plats.	Treatment.	Hay in excess of amount produced by plat 6.	Mutton in excess of amount produced by plat 6.	Hay consumed per pound of gain in live weight of sheep.	Average live weight of sheep.	Average dressed weight of sheep.
		Per cent.	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Cotton-seed cake	24	149	22.1	103	54
2	Lime	3	7	43.3	81	37
3	Full dressing of slag	53	175	24.6	108	56
4	One-half dressing of slag	34	74	34.3	101	47
5	Superphosphate	29	77	32.1	101	52
6	Nothing			44.3	98	50
7	Superphosphate + potash	*a* 3	114	20.0	104	54
8	Superphosphate + lime	27	109	27 0	112	56
9	Superphosphate + ammonia	37	92	31.7	98	50
10	Dissolved bones	39	95	31.7	107	54

a Decrease.

Some experiments on the fattening value of certain foods gathered by pigs, R. L. Bennett (*Arkansas Sta. Bul. 54, pp. 83–86*).—The value of Spanish peanuts, chufas, and soy beans for pigs was tested. These crops were grown on sandy loam cotton soil, producing on an average 30 bushels of corn to the acre. The pigs were confined with movable fence on small areas of each crop. For purposes of comparison, one lot of pigs was fed corn in the ear. The test was made with 2 lots of 4 pigs, and 2 lots of 3 pigs. At the time of feeding the soy bean

pods were well filled out and some were changing color. As the feeding progressed and the pods dried, the pigs showed a preference for the green ones, eating them first. The test was continued for 46 days with the lots fed peanuts, chufas, and corn. With the lot fed soy beans, it was continued for only 32 days, since the soy beans were eaten sooner than was expected.

The pigs fed peanuts, soy beans, and chufas gathered the crop on one-third of an acre. Those fed on corn consumed 23 bushels. The average results of the test are shown in the following table:

Results of pig-feeding experiment.

	Number of pigs.	Weight of lot at beginning.	Weight of lot at end of 32 days.	Weight of lot at end of 46 days.	Gain of lot in 32 days.	Gain per pig per day in 46 days.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (peanuts)	4	466	760	884	294	2.2
Lot 2 (soy beans)	4	499	590	....	91	....
Lot 3 (corn)	3	417	646	754	229	2.4
Lot 4 (chufas)	3	364	482	562	118	1.4

The estimated quantity of pork produced per quarter acre of peanuts was 313 lbs., chufas 138 lbs., and corn 109 lbs. "With the corn-fed pigs the ratio of gain to corn consumed is quite large, but the thrifty condition of the pigs and their size at the beginning of the test, and the short period of feeding, are doubtless the causes. The peanut fed pigs gained practically as much as the corn-fed pigs and harvested their own food."

The fat of the pigs fed soy beans and chufas was of about equal firmness, but not quite as firm as that of pigs fed corn. The fat of the pigs fed peanuts was soft and oily. When cooked, no difference could be detected in the flavor of the meat of the pigs in the different lots.

Feeding acorns, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 1, pp. 6-9*).—The composition of acorns is quoted and compared with that of corn. The successful feeding of 400 pigs on acorns and kitchen slops is reported. The acorns were also fed to milch cows in place of grain with satisfactory results, 2 qt. or 5 lbs. being fed daily. "While the milk did not materially increase as to quantity, it greatly improved in the amount of butter fat." So far as observed there were no bad effects on the butter. Horses are also said to be fond of acorns, and a statement concerning their successful use as a poultry food is quoted.

"In feeding acorns there is this precaution necessary: Where large quantities are given, plenty of laxative food should be included in the ration, as they are rather binding in their nature and likely to produce harmful results. . . .

"In feeding them to hogs, we find that rather a soft, spongy flesh is produced with an oily-like lard that hardens with great difficulty and frequently not at all. This is readily overcome by feeding corn 2 or 3 weeks before butchering, although many hundred pounds of meat go into market without complaint that have never been topped off with corn."

Poultry notes, F. E. HEGE (*North Carolina Sta. Bul. 152, pp. 21*).—The bulletin describes a portion of the work of the poultry section of the station for the year ending July 12, 1898. The houses and appliances are described, as well as the diseases observed among the poultry and the treatment followed. A feeding experiment with ducks and 3 tests with chickens hatched in incubators are also reported.

Disease experiments (pp. 6–13).—Little disease was observed among the poultry. This is attributed to the fact that the fowls were kept clean and comfortable, the houses well cared for, and continual war waged on vermin.

A number of chickens were treated for diarrhea. From these cases and the experience of previous years—

"It seems that, if taken in time, a cleansing of the system by the use of either sweet oil or calomel, followed by soft food containing, say, 10 per cent black pepper (or less, if the fowl will not consume as much . . .), will almost invariably effect a cure, but if the trouble is not noticed at once cures are infrequent. What causes the occasional cases in the yard has not been determined, unless . . . the fowl in molting is naturally weaker than when in full feather. No severe cases have appeared except during the molting season."

Several of the chickens suffered with sore head. Some of the cases were successfully treated with an application of copper sulphate.

"Sore head is a serious drawback to poultry raisers in the South and if the disease strikes a flock during June or July, nothing could do the fowls more damage, as it is extremely contagious, apparently healthy fowls one day being covered with sores on the head the next. . . .

"Sore head in winter is indeed a rare occurrence and that is another indication that stagnant blood is really the prime cause of the disease. Sulphur and salts both act on the system of the fowl, cleansing it from almost any lingering disease germs."

Feeding powdered sulphur mixed with the morning food 3 times a week ($\frac{1}{2}$ lb. to each $\frac{1}{2}$ gal. of food) and adding $\frac{1}{4}$ lb. Epsom salts to the gallon of drinking water is regarded as a satisfactory preventive of sore head. This was followed from March 1 to October 1.

A number of cases of roup were also treated.

"There is no doubt that the colds which had developed into mild cases of roup were caused by the chickens roosting where the chilly night air was continually upon them. We . . . are satisfied that if the fowls are placed in positions not exposed to draughts the disease is not necessarily contagious. Previous experiments made by the writer in 1891 and 1892 fully convinced him of the foregoing. There can be little doubt that if a laxative had been given the subjects when first isolated and nostrils had been cleansed daily their period of confinement would have been decreased by several days."

Feeding experiments with Pekin ducks (pp. 13–15).—Eighteen Pekin ducks were fed 56 days from the time they were hatched. At the beginning of the test the total food consisted of 4.4 oz. of meal and an equal amount of bran per head daily, while at the close of the test 6 lbs. 10 oz. of meal, 4 lbs. 3 oz. of bran, and 3 lbs. 5 oz. of bone were fed daily. In addition to the grain an amount of fine grit equal to one-sixth of the weight of the grain and chopped green clover equal to

one-fourth the bulk of the ration were also fed. All the feed was mixed with water to a crumbly mass and fed in troughs. No water was allowed except for drinking purposes.

The financial statement is based on corn meal at 1 ct., wheat bran at 0.9 ct., cut bone at 1 ct., and grit at 1 ct. per pound. Account was also taken of the value of the clover fed, the eggs set, and the food of the hens carrying the ducks. The ducks weighed 2 oz. when hatched and 4 lbs. 15½ oz. at the close of the test. The cost of a pound of gain was 5.05 cts. The ducks sold for 50 cts. each.

Incubator tests (pp. 16–22).—In the first test reported 86 strong chickens were hatched from 250 eggs. Accidental causes are believed to account for the apparently poor hatch. The chickens were fed for 8 weeks. During this time 13 chicks died. The average weight of the chickens when 8 weeks old was 1.49 lbs. Taking into account the cost of the food and eggs set, heat for the incubator, etc., the average cost of a pound of gain was 6.96 cts.

In the second test reported, 135 chickens were hatched from 200 eggs. The chickens were fed for 8 weeks, during which time 9 chickens died. The average weight of the chickens when 8 weeks old was 1.49 lbs. The average cost of a pound of gain was 6.42 cts. In this test a simple homemade brooder was used. It was heated with hot water. The total cost, including labor and lumber, was about $3.

In the third test only 65 chickens were obtained from 200 eggs. Accidental causes were believed to account for the poor hatch. A plan is suggested for keeping a monthly record of a poultry yard.

Food supply, R. BRUCE (*London: Charles Griffin & Co., Ltd.; Philadelphia: J. B. Lippincott Co., 1898, pp. 159, figs. 76*).—This volume, which is described in the subtitle as "a practical handbook for the use of colonists and all intending to become farmers abroad or at home," contains chapters on climate and soil, drainage and rotation of crops, seeds and crops, vegetables and fruits, cattle and cattle breeding, sheep, pigs, poultry, horses, the dairy, the farmers' implements, and notes on the settler's home. In an appendix preserved and concentrated foods are treated of.

Concerning sitos [a prepared wheat food], E. CAPPELLETTI (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1 (1898), No. 6, pp. 384–389*).—Sitos is a preparation of wheat made by splitting the grain lengthwise and removing the outer layer by a special process. It is made from hard Sardinian wheat (*Triticum durum*). Analyses of sitos, rice, and Italian paste are reported. The digestibility of each of the materials was tested with 3 men. The average coefficients of digestibility are shown in the following table:

Coefficients of digestibility of sitos, rice, and Italian paste.

	Nitrogen.	Fat.	Carbohydrates.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Sitos	78.73	92.03	96.14	75.57
Rice	69.29	92.59	97.36	73.98
Italian paste	86.93	87.86	97.35	72.24

In each case the materials were cooked in a thick soup.

Directions for sampling foods, condiments, and commercial products, G. RUPP (*Anleitung zur Probeentnahme von Nahrungs- und Genussmitteln sowie Gebrauchsgegenständen. Karlsruhe: F. Gutsch, 1899, pp. 40; rev. in Ztschr. Untersuch. Nahr. u. Gennussmtl., 2 (1899), No. 2, pp. 399, 400*).

The adulteration of flour with rye, buckwheat, rice, barley, maize, beans, and potato starch, BALLAND (*Jour. Pharm. et Chim., 9 (1899), 6. ser., No. 5, pp. 239–243; 6, pp. 286–290*).

The adulteration of coffee and tea, W. A. WITHERS and G. S. FRAPS (*North Carolina Sta. Bul. 154, pp. 35–48*).—The examination of a number of samples of coffee and tea is reported. The adulteration of these articles is discussed at some length.

Lessons in domestic science, ETHEL R. LUSH (*London and New York: The Macmillan Co., 1898, pt. 1, pp. 88, figs. 49; pt. 2, pp. 77, figs. 48*).—These books are written to meet the requirements of different grades in English schools.

Food preservatives, A. HILL (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 1, pp. 171–186*).—This general discussion of the subject is from the author's presidential address before Section 1 (Sanitary Science and Preventive Medicine) of the Sanitary Institute Congress at Birmingham in 1898.

Maize and its uses, R. W. DUNHAM (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 1, pp. 116–136*).—The author discusses the botanical structure and food value of maize and compares it with other feeding stuffs.

The food value of fruits, W. H. JORDAN (*New York Agr. Soc. Rpt., 1897, pp. 577–584*).—A popular discussion of the subject.

Food value and yield of Guinea grass (*Roy. Bot. Gard. Trinidad Bul. Misc. Inform., 3 (1898), No. 18, pp. 159–162*).—The composition and yield of Guinea grass (*Panicum maximum*) is reported and the composition compared with that of clover hay, vetch, Bahama grass, and Para grass.

Wheat offals sold in Maine in 1898, C. D. WOODS (*Maine Sta. Bul. 47, pp. 8*).—This bulletin contains analyses of wheat bran, middlings, mixed foods, and other refuse milling products of wheat collected by the station in the State during 1898.

Feeding stuff inspection, C. D. WOODS (*Maine Sta. Bul. 48, pp. 16*).—The more important concentrated feeding stuffs are described, and the requirements of the feeding stuff law are briefly given.

The chemism of peptic and tryptic digestion of protein, D. LAWROW (*Ztschr. Physiol. Chem., 26 (1899), No. 6, pp. 513–523*).

On absorption in the small intestine, R. HÖBER (*Arch. Physiol. [Pflüger], 74 (1899), No. 5–6, pp. 246–271*).—A second communication on this subject. A number of experiments are reported and discussed on theoretical grounds.

The carbon dioxid content of inspired air indoors and out of doors, K. B. LEHMANN, G. FUCHS, and H. SCHMIDT (*Arch. Hyg., 34 (1899), No. 4, pp. 315–320*).

The use of the metabolism of energy in the animal body in computing correct feeding standards, C. LEHMANN (*Landw. Vers. Stat., 51 (1898), No. 2–3, pp. 185–188*).—A controversial article.

Proceedings of the second convention of the Society for the Rational Feeding of Farm Animals (*Compt. Rend. 2me Congrès Soc. Aliment. Rat. Bétail, 1898, pp. 146*).—In addition to routine business, the report contains a number of special articles, among others experiments on fattening animals made in France and in foreign countries in 1897–98, the relative feeding value of hay and alfalfa, adulteration of feeding stuffs, and feeding race horses. Several articles on calf feeding are also reported and experiments with rabbits on the digestibility of different sorts of fodder beets and carrots.

Experiments on pork and beef as money crops for cotton farmers, R. L. BENNETT (*Sup. Circ. to Arkansas Sta. Bul. 54, pp. 4*).—Owing to the low price of cotton, attention is called to the fact that other crops may be more profitably grown if they are fed to pigs and steers. Results of tests at the station are cited in proof of this.

Poultry in Belgium (*U. S. Consular Rpts., 1899, No. 223, pp. 648, 649*).—A brief

account is given of raising and marketing poultry in Belgium. When about 3 months old the chickens are confined in coops and fed ground buckwheat, mixed with milk, morning and afternoon, and at noon milk or milk and water. If the fowls refuse the food, they are not forced to eat, but are removed from the coop and killed, as they grow thin otherwise and lose market value. The fowls are generally kept in the fattening coops from 4 to 5 weeks.

DAIRY FARMING—DAIRYING.

The water content of butter, B. Martiny (*Landw. Jahrb., 27 (1898), No. 6, pp. 773–963*).—This is a very extensive compilation of analytical work bearing on the water content of butter in different countries. The work done at the Wisconsin, Vermont, Massachusetts, and Connecticut stations is included. Data for 20,706 analyses are brought together and classified by countries and in various other ways. A summary of the range and average water content for different kinds of butter is given as follows:

Summary of water content of butter.

	Number of samples.	Water content.			Range of water content.
		Lowest.	Highest.	Average.	
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Fresh dairy or creamery butter (all countries):					
Unsalted	831	6.86	27.51	14.10	20.71
Salted	17,332	3.84	22.12	13.55	18.28
Peasant butter (Germany):					
Unsalted	738	3.68	41.60	14.79	37.92
Salted	841	4.32	49.02	14.74	44.70
Butter packed for keeping (all countries)	113	5.06	21.30	10.73	16.24
Hamburg packing stock ("Packbutter")	819	16 −	24 +	23.00	12 +
Whey butter:					
Unsalted	30	10.09	20.68	15.58	10.59
Salted	2	14.05	14.73	14.39	.68
Total range and average	20,706	3.68	49.02	14.03	45.34

For fresh dairy and creamery butter the range and average of the water content are given by countries as follows:

Water content of dairy and creamery butter from different countries.

	Unsalted.				Salted.			
	Number of samples.	Lowest.	Highest.	Average.	Number of samples.	Lowest.	Highest.	Average.
		Per cent.	*Per cent.*	*Per cent.*		*Per cent.*	*Per cent.*	*Per cent.*
Germany	523	9.10	23.60	13.96	1,107	5.90	22.12	13.01
Austria	38	8.53	19.50	14.51				
Switzerland	9	6.80	15.40	12.70				
Italy	53	8.54	19.78	13.67	6	10.02	12.79	11.52
France	62	9.80	18.00	13.57	225	9.68	21.10	13.40
Netherlands	4	13.67	14.22	13.96	63	7.70	20.80	13.07
England	30	11.87	16.26	13.51	334	4.91	20.75	12.08
Denmark	93	12.73	19.85	15.16	9,847	8.98	19.88	13.99
United States	17	13.05	27.51	17.17	596	7.11	20.00	11.53
Australia and New Zealand	2	9.36	11.91	10.64	62	6.00	16.00	11.38
Sweden					4,423	8.87	20.22	13.66
Finland					438	8.10	15.30	11.18
Canada					207	3.84	19.70	8.97

Portions of the data are arranged to show the effect on water content, if any, of the season of the year, breed of cows, feed, methods of butter making, salting, keeping, and other factors; and based upon these considerations the author makes some deductions as to the limits of the allowable water content of different classes of butter. He concludes that, from the data at hand, salted or unsalted butter which contains more than 20 per cent of water has unquestionably been either very carelessly made or purposely adulterated, and accordingly should be excluded from public sale as not fulfilling the reasonable expectations of the consumer. Since the data for the better class of butter (from dairies and creameries) show that the averages for different countries do not exceed 14 per cent of water; that at present fully four-fifths of all the butter contains less than 16 per cent of water; that butter regarded as good only occasionally exceeds 15 per cent of water, and that an unusually high water content can be corrected by proper feeding or methods of making, the author concludes that commercial table butter should not contain, as a rule, more than 16 per cent of water, and that all butter which contains from 16 to 20 per cent of water should be classed as more or less inferior, according to its fat content—i. e., as cooking or baking butter.

Finally, a suggestion is made for the legal regulation of the sale of butter in Germany, defining butter and fixing the following limits: Butter fat, at least 80 per cent in table butter and 76 per cent in cooking or baking butter; nonfatty organic solids (casein, milk sugar, lactic acid, etc.), not exceeding 2 per cent; water, under 16 per cent in table butter and under 20 per cent in cooking or baking butter; salt, not over 3 per cent in table butter or over 5 per cent in cooking or baking butter.

The causes of the rancidity of butter, C. Anthor (*Ztschr. Analyt. Chem.*, *38* (*1899*), *No. 1*, *pp. 10–20*).—The author made a study of total acids, volatile acids, esters, etc., of sweet and sour cream butter when new and at different stages of rancidity. He finds that both sour-cream butter and rancid butter contain alcohol, and that all butters contain volatile bodies saponifiable by potash. Rancid butter also contains esters of the free volatile fatty acids, principally ethyl ester of butyric acid. The principal reason why a butter becomes rancid is said to be the intensive development of "bouquet," which soon renders the butter unfit for use, although the taste remains normal and the total acid is much below Stockmeier's maximum of 8. The rancid odor is caused principally by a mixture of small amounts of volatile fatty acids and ester. In distillation the butyric-ester odor is at first very intense. As butter becomes older the development of bouquet reaches a maximum, after which it decreases nearly to zero. In this condition the butter is tallowy. Sweet-cream butter becomes rancid much more slowly than sour-cream butter and does not equal it in the development of bouquet.

The cause of the formation of these odors in the butter is attributed to micro-organisms which produce alcohol from the milk sugar, a cleavage taking place simultaneously in the glycerids, which yield acid for the formation of esters. As the glycerid of butyric acid is the least stable, this is usually principally affected. The freed glycerin undergoes various changes, forming aldehydes and keton-like bodies, according to Schmid[1] and Mayrhofer. The author coincides with the view of Schmid, that the processes of becoming rancid and of becoming sour are not identical. Rancidity of butter in the stage of development of bouquet is regarded as different from the rancidity of other fats, in which the odor is of less importance, and the fat is rendered unfit for food mainly by the irritating taste.

Tubercle bacilli in market butter, OBERMÜLLER (*Hyg. Rundschau, 9 (1899), No. 2, pp. 57-79*).—In a preliminary communication on this subject[2] it was reported that 14 samples of Berlin butter, tested by injecting 5 or 6 guinea pigs with each sample, were found to be infected with virulent tubercle bacilli. Every animal receiving injections of butter in the abdominal cavity showed signs of tuberculosis, and this was corroborated by numerous cultures from the affected parts, which showed tuberculosis in a high degree.

The present paper is partly controversial and discusses the earlier investigation in more detail, with a verification of the results on preserved specimens of affected parts of the animals. It also contains the results of tests, by means of guinea pigs, of 10 additional samples of first-quality butter procured from the same source as in the first investigation. Four samples showed positive evidence of the presence of true tubercle bacilli. Animals injected with other samples were made very sick, and cultures made from the slaughtered animals contained tubercle bacilli in some cases. It was found, in agreement with others, that the action of only slightly pathogenic bacteria was much intensified by the presence of butter fat. For this reason, the treatment of the melted butter in a centrifuge and the use of the sediment for injection is believed to give more reliable results than injection with butter directly.

The author states in conclusion that a large proportion of the butter samples examined by him contained tubercle bacilli, and the presence of these bacilli in butter in most cities is probably not infrequent. State control of dairy herds is strongly recommended.

Experiments with calcium chlorid for rendering heated milk suitable for cheese making, KLEIN and A. KIRSTEN (*Milch Ztg., 27 (1898), No. 50, pp. 785-787; 51, pp. 803-805*).—This investigation was suggested by the practice of sterilizing milk for butter making and the resulting difficulty of using the skim milk for cheese making. Three series of experiments were made, including a large number of trials in

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[1] Ztschr. Analyt. Chem., 37 (1898), p. 301.

[2] Hyg. Rundschau, 7 (1897), pp. 712-714.

each, separator skim milk being heated to 75° C. for 15 minutes in the first series, to 85° for 10 minutes in the second, and to 100° for 2 minutes in the third. In each experiment 20 liters of skim milk was used, varying quantities of calcium chlorid being added in different cases, and none in some cases. Cheese was made in each case.

In the first series, where the milk was heated to 75° C., it was found that there was little difficulty in making cheese from the milk, either with or without the addition of calcium chlorid, but the authors recommend adding to such milk the equivalent of 10 gm. of calcium oxid per 100 liters of milk, to facilitate the curdling.

The cheese made from milk heated to 85° C. and treated with calcium chlorid resembled in many respects that made in the first series of experiments. The yield of cheese was in all cases greater where the calcium chlorid was used than in the control experiments. The green cheese also contained more water, but even on the basis of dry matter the yield was greater. The greatest difficulty in making cheese from this kind of milk was found to be the time required for the complete separation of the whey from the curd.

The use of calcium chlorid was also found to restore the ability of milk heated to 100° C. to curdle, but to accomplish this in the same time 2½ times as much calcium chlorid was required as in the first series. The separation of the whey was very slow and difficult, and the curd itself was unusually rich in water, and was changed to a grayish-white appearance and a finely granulated condition, with very little tendency to adhere together. The addition of larger quantities of calcium chlorid improved the adhesive qualities of the curd, although it did not entirely remove the difficulty. Experiments made in subsequent heating to 40° C. to hasten the separation of the whey and to make the curd more adhesive resulted favorably, and this is to be the subject of further investigation.

In a later note in the same journal (No. 53, p. 810) it is stated that all difficulties in making cheese from milk heated to 85° have been overcome, and that the process is rendered as simple as ordinary cheese making. A description of the method is promised.

An inquiry concerning the source of gas and taint-producing bacteria in cheese curd, V. A. MOORE and A. R. WARD (*New York Cornell Sta. Bul. 158, pp. 221–237, pl. 1*).—A study was made of this trouble, which occurred at a cheese factory and was popularly supposed to be due to decomposed retained placentas. An examination of the gassy and tainted curd "showed that both the taint and the gas were caused by the same species of gas-producing bacteria, a micro-organism resembling very closely, if not identical with, *Bacillus coli communis*." Cheese made from sterilized milk inoculated with this bacillus developed the gassy curd and taint. A search for the source of this bacillus showed that it was not in the rennet or in the water used in the cleaning. A bacteriological examination was then made of the milk of the individual cows in the suspected dairy. This showed that the gas and

taint-producing bacteria were present more or less constantly in the milk of each animal, and that the milk of the cows which had suffered from retained placenta was, as a rule, no worse than that of the other cows. Examination of the dust and filth from the stable gave negative results, and the inference was reached that the bacteria had become colonized in the udders of certain of the cows. This, however, could not be positively determined.

The examination of the teats and udders of a number of cows which were slaughtered on account of tuberculosis (not from the infected dairy, however) showed that "bacteria were there and remained there after milking, ready to infect the milk of the next succeeding milking," but no gas-producing bacteria were found in any of the udders examined.

Two experiments were made to test the power of bacteria to pass from the intestines to the udder, the cows being given drinking water containing 1 to 2 qt. of a bouillon culture of *Bacillus prodigiosus* daily for nearly 2 weeks, and the milk examined for this organism with negative results. A repetition of the experiment, using cultures of the gas-producing bacillus from cheese curd, also gave negative results.

A technical description is given of the gas-producing bacillus, which is believed to be "closely related to, if it does not belong in, the colon group of bacteria."

Cleanliness in the stable and in the care of the cows is believed to be the best preventive of the trouble. The disinfection of the milk ducts by washing them out with a germicide by means of a milking tube, as reported by a German experimenter, was not successful in the hands of the authors.

Changes in fat during the ripening of cheese, A. KIRSTEN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 1 (1898), No. 11, pp. 742–759*).—Four sorts of cheese, Camembert, Neufchatel, Tilsiter fat, and Holland, were examined with reference to the changes in the fat. The fat was separated from the cheese with ether by triturating the ground or broken-up cheese in a mortar with ether, the free acids being neutralized with potassium hydrate. The mass was then shaken vigorously, the ether being renewed from time to time, and the shaking continued until the ether extract contained no trace of fat. The ether-fat layer was then separated by centrifugal force and the fat freed from the ether by distillation and dried in hydrogen at 100°. The volatile and the insoluble fatty acids and the saponification equivalent were determined in the fat, as well as the index of refraction. The cheese was further examined as to the solids-not-fat, ash, salt, and total nitrogen; and the solids-not-fat were examined for total solids, nitrogen, ash, and salt, and were extracted with water, the extract being examined for total solids, ash, and nitrogen in different forms.

The results showed that the fat separated from the different cheeses at different stages of ripening was very nearly uniform in composition. While a quantitative decomposition of the cheese fat is believed possible, these results indicate that where it takes place all parts of the fat

are uniformly decomposed. The view that the glycerids of the different fatty acids are associated with the ripening is thought to be disproved. The losses in absolute amount of fat during ripening were as follows: Camembert 0.12 per cent, Neufchatel 0.85, Tilsiter 0.19, and Holland 0.57; and of ether extract: Neufchatel 4.40, Tilsiter 2.96, and Holland 0.58 per cent. These losses the author regards as small and within control in the ripening room.

In discussing Weigmann and Backe's paper (E. S. R., 10, p. 789) the author states that the formation of free nonvolatile fatty acids observed by them in ripe cheese is not a proof of a decomposition of the neutral fat of the cheese, since these could just as well have originated from decomposing nonfatty constituents, especially the albuminoids.

Changes in fat during the ripening of cheese, H. WEIGMANN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 1, pp. 31, 32*).—The author takes exception to the above explanation of Kirsten of the free nonvolatile fatty acids found by Backe and himself in cheese. He contends that numerous investigations have shown that fat is not formed from the albuminoids in cheese ripening, and that Cohn has shown that in the cleavage of casein by hydrochloric acid the higher fatty acids are not formed. The formation of volatile fatty acids from casein is admitted, but no weight was placed by Weigmann and Backe on the determination of these.

The author criticises Kirsten's results, claiming that the method of fat separation employed extracted only the unaltered fat of the cheese. He asserts that Kirsten's conclusions are not warranted, and that his paper does not change the status of the question.

Feeding dairy cows, T. L. HAECKER (*Minnesota Univ., Dept. Agr., Class Bul., pp. 20*).—The author discusses the principles of feeding, the composition of feeding stuffs, and the application of these data. He presents in tables the composition of various feeding stuffs and their comparative money value, based upon timothy hay and bran at different prices, and upon their digestible protein content. The compounding of rations to meet the feeding standards is discussed and illustrated by examples.

"That generous feeding pays is clearly illustrated in our record for the 5 years ending December 30, 1897. During the years 1893, 1895, 1896, and 1897 cows were fed all they would take, while during the year 1894 they were fed light.

Yield of milk and butter by herd.

Year.	Yield of— Milk.	Yield of— Butter.	Cost of 1 lb. of butter.
	Pounds.	*Pounds.*	*Cents.*
1893	6,407	364	10.6
1894	4,909	271	10.9
1895	7,418	352	8.0
1896	7,454	349	6.3
1897	6,962	351	5.4

"These are averages of the entire herd, and show that during the 4 years when receiving all they would eat up clean they averaged 354 lbs. of butter each, while the average yield for the year 1894, when on comparatively light feed, was only 271 lbs. The cost of production was also the greatest that year."

A new scale of points for judging dairy cows, C. L. BEACH (*Hoard's Dairyman, 30 (1899), No. 9, pp. 176, 177, fig. 1*).—A description of the scale, with examples of its use on the cows of the Storrs Agricultural College.

Colostrum, E. UNGER (*Arch. Path. Anat. u. Physiol.* [*Virchow*], *151 (1898), No. 1, pp. 159–175, pl. 1*).—A résumé of the literature of colostrum and a study of the physiological process of colostrum formation on human subjects.

Researches on milk—determination of watering, A. VILLIERS and M. BERTAULT (*Bul. Soc. Chim. Paris, 19 (1898), No. 7, pp. 305–310*).

A modification of the Babcock milk test, M. SIEGFELD (*Molk. Ztg., 13 (1899), No. 4, pp. 51, 52*).—To avoid cloudiness of the fat column and make the line of demarcation more distinct, it is proposed to fill the bottles, after the first whirling, with sulphuric acid of 1.5 sp. gr. instead of with water. It is noted also that a clear fat column can be obtained with one whirling by using amyl alcohol and filling with sulphuric acid of 1.5 sp. gr. Several comparative tests are reported.

The determination of the dirt in milk, R. EICHLOFF (*Milch Ztg., 28 (1899), No. 5, pp. 65, 66*).—A study was made of the Stutzer method in common use, which resulted in showing that method to give too low results.

The sterilization of milk, MACFADYEAN and HEWLETT (*Trans. British Inst. Prevent. Med., 1897; abs. in Hyg. Rundschau, 9 (1899), No. 6, p. 308*).—The authors discuss the pasteurization of milk and the efficiency of a temperature of 55 to 65° C. in destroying disease germs. They describe an apparatus which consists of a system of spiral tubes through which the milk passes and in which it is alternately heated to about 70° C. and cooled. Milk can be effectively pasteurized on a commercial scale with this apparatus without any change in taste or appearance. Special experiments with pure cultures of pathogenic bacteria showed that these were killed by the treatment.

Embalming milk (*Hoard's Dairyman, 30 (1899), No. 9, p. 167*).—Remarks on the use of "Freezene" as a milk preservative. The active principle of this preservative is said to be formic aldehyde.

Bacteria in lacteal secretion, U. TRINCI (*Abs. in Jour. Hyg., 23 (1898), No. 1157, p. 559*).

Biological studies of Clostridium licheniforme and Paraplectrum fœtidum, H. WEIGMANN (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 22, pp. 820–834, pls. 2*).

Denaturation of margarin, V. MAINSBRECQ (*Bul. Assoc. Belge Chim., 12 (1898), No. 5–6, pp. 185, 186*).

A new method of butter making (*Milch Ztg., 27 (1898), No. 53, p. 842*).—A description of the so-called Norstedt method. The butter is washed thoroughly with cold water as soon as it is churned, and immediately worked and salted. Butter made by this method was found to contain less casein and slightly more water than ordinary butter. The butter is deficient in aroma, as would be expected, but has the advantage of unusual keeping qualities.

Whey butter (*Queensland Agr. Jour., 4 (1899), No. 2, pp. 112, 113*).—Popular directions for making whey butter. "In the experience of the writer, the whey obtained from 60 gal. of milk is sufficient to afford 1 lb. of finished butter."

Passage of the reaction of cotton-seed and peanut oil in butter, F. WERENSKIOLD (*Jahresber. Öffentl. Förd. Landw. Norwegen, 1897; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 2, p. 162*).—Arachidic acid could not be detected in butter after feeding cows on ground peanut cake (1 kg. per day). When the same amount of cotton-seed meal was given, the butter obtained thereafter showed the reaction of the corresponding oil. The cotton-seed oil reaction was never observed except after feeding with cotton-seed meal.

The systematic butter exhibitions in Denmark and Sweden, R. EICHLOFF (*Molk. Ztg., 13 (1899), No. 1, pp. 3, 4*).—A description of these exhibitions and their operation, drawn from personal observations of the author.

The preparation of Tilsiter cheese, R. EICHLOFF (*Molk. Ztg., 13 (1899), No. 2, pp. 19, 20*).—A description of the methods employed in making this kind of cheese.

A new alcoholic fermentation product from skim milk and whey, A. G. EKSTRAND (*Milch Ztg., 28 (1899), No. 2, pp. 21, 22*).—A note on a new cheap alcoholic beverage.

AGRICULTURAL ENGINEERING.

Farm drainage—why and how, J. J. W. BILLINGSLEY (*Drainage Jour., 21 (1899), No. 4, pp. 90–94*).—A popular discussion of the subject.

Automatic division of irrigation water, W. M. BRISTOL (*Pacific Rural Press, 57 (1899), No. 10, p. 145, figs. 2*).—The construction and mode of operation of an adjustable automatic weir in use in the Highland district, San Bernardino County, California, are described.

Plows in Italy, H. A. JOHNSON (*U. S. Consular Rpts., 1899, No. 223, pp. 614–616*).—An account of field trials of plows made by three German firms.

Agricultural machines competing at Paris, M. RINGELMANN (*Jour. Agr. Prat., 1899, I, No. 13, pp. 464–470, figs. 6*).

Trials of farm machinery, 1898, U. SVERDRUP ET AL. (*Christiania, 1899, pp. 69, ill.*).—The report gives detailed results of working trials with farm machinery conducted by the Royal Society for Norway's Weal, and includes trials of 7 two-horse and 9 one-horse mowers, 10 horse rakes, and 4 hay tedders. Nearly all the leading American farm-machinery firms were represented, and the machines awarded first diplomas were, without an exception, of American manufacture. The working trials were made according to a carefully prepared plan and scores given for quality of work done, for work in relation to draft, construction, and durability, and attention required during operation.—F. W. WOLL.

Agricultural electrotechnics, R. H. THURSTON (*Science, n. ser., 9 (1899), No. 222, pp. 480, 481*).—A review of an article by P. Renaud on agricultural electrotechnics in Germany and its future in France and her colonies, published in *Bul. Soc. Encouragement Ind. Nat., 1899, Jan., p. 15.*

Cigar leaf-curing barn (*Queensland Agr. Jour., 4 (1899), No. 2, p. 107*).—Brief directions for constructing a tobacco barn.

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Alabama College Station, 1897 (*Alabama College Sta. Rpt. 1897, pp. 28*).—This contains brief outlines of the work of the different departments and a financial statement for the fiscal year ending June 30, 1897.

Organization and work of the Tuskegee Experiment Station, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 1, pp. 3–5*).—The station staff, the act of the Alabama legislature establishing the station, and brief notes on the proposed work of the station are given.

Sixteenth Annual Report of New York State Station, 1897 (*New York State Sta. Rpt. 1897, pp. 661*).—This contains the report of the treasurer for the year ending September 30, 1897, a meteorological record for the year, and reprints of Bulletins Nos. 117–142 of the station, excepting Nos. 120 and 122, on the following subjects: Treatment of leaf spot in plum and cherry orchards in 1896 (E. S. R., 9, p. 148); alfalfa (E. S. R., 9, p. 133); the downy mildew of the cucumber, what it is, and how to prevent it (E. S. R., 9, p. 248); spray pumps and spraying (E. S. R., 9, p. 262); spraying potatoes on Long Island in the season of 1896 (E. S. R., 9, p. 765); anthracnose of the black raspberry (E. S. R., 9, p. 762); forcing tomatoes, comparison of methods of training and benching (E. S. R., 9, p. 1051); notes on a tomato disease (E. S. R., 9, p. 1058); feeding experiments with chicks and capons (E. S. R., 9, p. 1076); strawberries

in 1897 (E. S. R., 9, p. 1052); variety tests with raspberries, blackberries, and dewberries (E. S. R., 9, p. 1052); analyses of commercial fertilizers for 1897 (E. S. R., 9, p. 1042; 10, p. 36); a bacterial disease of sweet corn (E. S. R., 9, p. 1056); results with oat smut in 1897 (E. S. R., 9, p. 1060); the source of milk fat (E. S. R., 9, p. 1083); spraying in 1897 to prevent gooseberry mildew (E. S. R., 9, p. 1061); the composition and production of sugar beets (E. S. R., 10, p. 145); inspection of nurseries and treatment of infected nursery stock (E. S. R., 10, p. 468); commercial fertilizers for potatoes (E. S. R., 10, p. 431); experiments and observations on some diseases of plants (E. S. R., 10, pp. 452, 453, 454); plant lice, descriptions, enemies, and treatment (E. S. R., 10, p. 467); wood ashes and apple scab (E. S. R., 10, pp. 437, 452); digestion and feeding experiments (E. S. R., 10, p. 476); report of the director of New York State Station (E. S. R., 10, p. 498).

Seventeenth Annual Report of Ohio Station, 1898 (*Ohio Sta. Rpt. 1898, pp. XXIII, map 1*).—This contains reports of the board of control, the treasurer for the fiscal year ending June 30, 1898, and the director, including a brief outline of station work for the year, a subject list of Bulletins 85–95, a list of the publications received during the year, and acknowledgments of miscellaneous donations.

Tenth Annual Report of Texas Station, 1898 (*Texas Sta. Rpt. 1898, pp, 1111–1144, pls. 3*).—This consists of a report by the director on the work of the college and substations, brief reports by the heads of departments, financial statements for the fiscal years ending June 30, 1897 and 1898, and an appendix containing a bibliography of agricultural publications.

Tenth Annual Report of West Virginia Station, 1897 (*West Virginia Sta. Rpt. 1897, pp. 66*).—This contains a financial statement for the fiscal year ending June 30, 1897, and reports by the director, agriculturist and horticulturist, entomologist (p. 1067), and chemist, reviewing the different lines of station work for the year.

An effort to help the farmer, I. P. ROBERTS (*New York Cornell Sta. Bul. 159, pp. 241–268*).—This is the fifth report of progress of the State extension work in agriculture. Part I deals with the investigational work of the station already reported in bulletins and that under progress, correspondence work, and itinerant teaching by means of schools and lectures; Part II deals with the nature-study and reading-course work. The previous reports are given in Bulletins 110, 122, 137, and 146 of the station (E. S. R., 8, pp. 135, 740; 9, p. 699; 10, p. 498).

Beet-sugar manufacture in Sweden, 1896 to 1897 (*Tidskr. Landtmän, 19 (1898), No. 2, pp. 30–32*).—This article gives statistics on the production of beet sugar in Sweden for the year ending September 1, 1897. Nineteen factories were in operation and 890,240.4 metric tons of beets were worked, being an average of 46,855 tons per factory. The total yield of sugar was 105,556.2 tons, of which 94,261 tons were first sugars, 9,649.5 seconds, and 1,645.7 tons thirds and fourths. Besides the sugar 25,615.8 tons of molasses were produced. The yield of sugar was 11.86 per cent of the beets worked; the first sugars amounted to 10.59 per cent of the beets; the seconds to 1.08 per cent, and the thirds and fourths to 0.19 per cent. The yield of molasses was 2.88 per cent of the beets. The average sugar content of the beets, as determined by means of the polariscope, was 13.56 per cent, the maximum being 14.59 and the minimum 12.26 per cent. The number of tons of beets worked was 66 per cent greater than in 1895 and the amount of sugar obtained was 70 per cent greater.—F. W. WOLL.

NOTES.

GEORGIA STATION.—A department of biology has recently been created in connection with the department of horticulture. A laboratory has been equipped for the study of injurious insects and fungi, and material additions to the scientific library have been made. The life histories of certain injurious insects are being studied, as well as methods for their control.

ILLINOIS UNIVERSITY AND STATION.—The last general assembly of Illinois voted $150,000 to erect and equip a building for instruction and investigation in agriculture at the University of Illinois. It also enacted that one-half of the funds arising from the land-grant act of 1862 and from the second Morrill bill of 1890 should be devoted to instruction in technical agriculture.

NEBRASKA STATION.—At a meeting of the board of regents of the University of Nebraska, held April 18–19, the office of assistant director of the station was created, and T. L. Lyon, agriculturist of the station, was appointed to the position. On account of lack of funds to carry into effect the purposes of the board in respect to the division of animal husbandry, the board was obliged to discontinue its temporary arrangement with Mr. C. H. Elmendorf, and ordered that the division of animal husbandry be placed in charge of the division of agriculture.

NEW YORK CORNELL UNIVERSITY.—The State assembly recently appropriated $35,000 to the College of Agriculture of the University for extension work in agriculture.

NEW YORK STATE STATION.—As a result of civil-service examination, Frederick H. Blodgett, B. S., has been selected as assistant botanist and entomologist at the branch station at Jamaica, Long Island, and has entered upon his work. The State legislature has passed and the Governor approved the following bills: (1) Renewing the regular annual appropriation of $50,000 for the station; (2) renewing the appropriation of $10,000 for fertilizer analysis for the current year; (3) changing the fertilizer law for the next year to require licensing each brand sold in the State at a cost of $20 per brand, the tax, or so much of it as needed, to pay expenses of collection of samples and analysis by the station; (4) placing sale of concentrated feeding stuffs under station control, requiring dealers to pay a tax of $25 per brand; (5) giving appropriation of $3,500 for constructing addition to cattle barn and other repairs; (6) appropriating $1,000 for inspection of Paris green and other insecticides.

WISCONSIN UNIVERSITY AND STATION.—Arthur G. Hopkins, D. V. M., has been appointed veterinarian of the agricultural college and experiment station.

WYOMING STATION.—Aven Nelson, botanist of the station, left Laramie early in June on an extended botanical survey of the Yellowstone National Park and the adjacent forestry reserves. In addition to large collections of the entire flora a careful study of the forage plants and range conditions is contemplated.

INSPECTION OF NURSERIES AND NURSERY STOCK IN INDIANA.—The legislature of Indiana has passed a law for the inspection of nurseries and nursery stock.

ERRATUM.—In the abstract of Bulletin 121 of the California Station (E. S. R., 10, p. 617) the difference in the moisture content of cultivated and uncultivated apricot orchards to a depth of 6 ft. was erroneously stated to be 244 *pounds* per acre instead of 244 *tons*.

NECROLOGY.—Dr. A. W. Chapman, the well-known Southern botanist, died suddenly at his home at Apalachicola, Florida, April 6, 1899, in his ninetieth year. His Flora of the Southern United States is well known to all systematic botanists.

Charles Naudin, a distinguished botanist and a member of the Institute of France, died March 19, 1899, in his eighty-fourth year. He was director of the experimental gardens at Villa Thuret, Antibes, an adjunct of the Jardin des Plantes, Paris. His work in horticulture, and especially his elaboration and elucidation of the cultivated species and varieties of cucurbits, gives him rank among the greatest garden botanists of the century.

Prof. C. Scheibler, the well-known sugar chemist, died at Berlin, April 2, 1899, aged 72 years. While distinguished mainly for his contributions to the chemistry of sugar and sugar-making, Professor Scheibler carried out important investigations in other lines, his work on phosphatic slags being of especial value to agriculture.

Prof. G. H. Wiedemann, the distinguished chemist and physicist and editor of Wiedemann's Annalen (Annalen der Physik und Chemie), died at Leipsic March 24, 1899, in the sixty-third year of this age.

EXPERIMENT STATION RECORD.

VOL. X. NO. 12.

With the present number the tenth volume of the Experiment Station Record is brought to a close. An indication of the ground which it covers, as compared with the preceding volume, is furnished by the following table:

Publications abstracted.	Volume IX.	Volume. X.
Station reports	56	35
Station bulletins	317	361
Publications of United States Department of Agriculture	201	172
Foreign articles	842	1,224
Total number of articles	1,810	2,023
Classified as follows:		
Chemistry	121	150
Botany	86	127
Fermentation and bacteriology	28	27
Zoology	31	23
Meteorology	57	46
Air, water, and soils	72	86
Fertilizers	85	109
Field crops	153	236
Horticulture	138	173
Forestry	16	34
Seeds and weeds	41	37
Diseases of plants	107	180
Entomology	252	202
Foods and animal production	186	223
Dairy farming and dairying	151	168
Veterinary science	134	86
Technology	11	6
Agricultural engineering	38	28
Statistics	103	82

The present volume contains 881 pages of abstracts, representing 57,230 pages in the original publications. In addition to these abstracts the volume contains the titles of 1,820 articles, mostly foreign, which are briefly noted, but not abstracted. There are also 14 editorials, occupying 24 pages; 9 special articles, occupying 94 pages, and 104 station and miscellaneous notes, occupying 17 pages.

The subject index, comprising this last number of the volume, has been made on the same general plan as that for previous volumes. The increased amount of material covered by the tenth volume has resulted in enlarging the index number considerably, since, as heretofore, the aim has been to index the contents in sufficient detail to serve as a guide to the publications reviewed.

As the Experiment Station Record was established soon after the agricultural experiment stations in the United States had completed their organization or reorganization under the Hatch Act, it contains an account of practically everything which the stations have done during the ten years in which they have received the support of the National Government. It would be interesting to review the history of their operations during this period, and to show in some detail how their operations have increased in number, variety, and importance; but this is too large a task to be undertaken at this time. There are, however, a few salient features of the development of the experiment station enterprise in this country to which it may be well to call attention in closing our record of their operations during the first decade under the Hatch Act.

The most obvious indication of the success of experiment stations as a means for improving agricultural conditions in this country is the steady increase in the number of stations and station officers, and in the amount of financial support which they have received from the National and State governments. In the first volume of the Record (p. 117) it is stated that in 1889 there were 46 stations in the United States receiving an aggregate revenue of about $725,000, of which $600,000 was appropriated from the National Treasury and $125,000 was received from State governments and other local sources. The total number of persons engaged in the work of the stations and at this Office that year was 402. In 1898, the last year for which statistics have been compiled, the total number of stations was 54. Their total income was somewhat over $1,200,000, of which $720,000 was received under the Hatch Act (in addition to $35,000 for this Office) and $480,000 from State governments and other local sources. The number of officers had increased to 669.

With the increase in the number of the stations and the enlargement of their resources there has been a corresponding increase in the number and variety of their publications, and these have been more thoroughly distributed each year. Besides the vast amount of agricultural information which has thus been generally diffused among our farmers, either directly through station publications or indirectly through the public press, more than fifty books on strictly agricultural subjects have been written by station men during the past ten years, and the results of the work of the stations are being largely incorporated in books whose authors are not connected with the stations. It requires only a superficial retrospect to discover a very remarkable difference in the freshness of material and the thoroughness of treatment of the published information available to our farmers ten years ago and that which is at their command to-day. It is most encouraging to observe that, despite the pessimistic predictions in certain quarters, the output of carefully prepared books for the farmer's use has notably increased within the past few years, and American books for the American farmer are written from an American standpoint and on the basis of accurate information obtained by American investigators.

It is evident that the results of experiment station work are beginning to have a broad effect upon our agriculture. This is seen in such matters as the more intelligent use of fertilizers, the reorganization of dairy farming and dairying on a scientific basis, and the widespread use of fungicides, insecticides, and other means for the repression of diseases of plants and insect pests. Very largely under the guidance of the stations the diversification of agriculture is proceeding in many regions where hitherto one or two crops have been the main reliance of the farmer. Much has also been accomplished in showing how former wasteful methods of farm management may be done away with, and how a variety of by-products of the farm may be utilized to reduce the net expense of the production of the great agricultural staples.

Ten years ago we were obliged to rely very largely on foreign sources for information regarding the composition and digestibility of feeding stuffs, but to-day we have abundant American data for the compilation of standard works on the feeding of animals under American conditions, and along with the more scientific study of animal nutrition there has been a large amount of painstaking and useful investigation of the practical and economic usefulness of a great variety of American feeding stuffs in all sorts of combinations. And going somewhat outside of the range of work for which our stations were originally established, an increasing amount of study has been devoted to the problems of human nutrition. Thousands of analyses of American food materials have been made, a considerable number of dietary studies have been conducted, and somewhat elaborate studies on metabolism and the conservation of energy in the human organism have been prosecuted with marked success. Congress and some of the State legislatures have recognized this as a legitimate sphere for the work of the stations, and the direct bearing which much of this investigation has upon the more purely agricultural problems is each year more clearly recognized.

The ten volumes of the Record just completed contain abstracts of 3,063 bulletins and 394 reports of American experiment stations, 900 publications of the United States Department of Agriculture, and 4,323 articles relating to agricultural investigation at experiment stations and similar institutions in foreign countries. These abstracts occupy 6,994 pages of the Record, and required in their preparation the reviewing of 285,623 pages in the original publications. The bibliography of the current literature is rendered more comprehensive by the noting of 14,539 articles, mostly foreign, which are either not abstracted or only quite briefly. The original articles in the Record, consisting of 167 editorials and 78 special articles, comprise 1,285 pages. The news items and miscellaneous notes, of which there are a total of 1,069, occupy 203 pages. This material has been indexed with sufficient detail to make it quite convenient of reference in the 10 index numbers, including both author and subject entries, which comprise nearly 900 pages of double-column matter.

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INDEX OF SUBJECTS.

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

Vol. X No. 5

EXPERIMENT STATION RECORD

WASHINGTON
GOVERNMENT PRINTING OFFICE
1899

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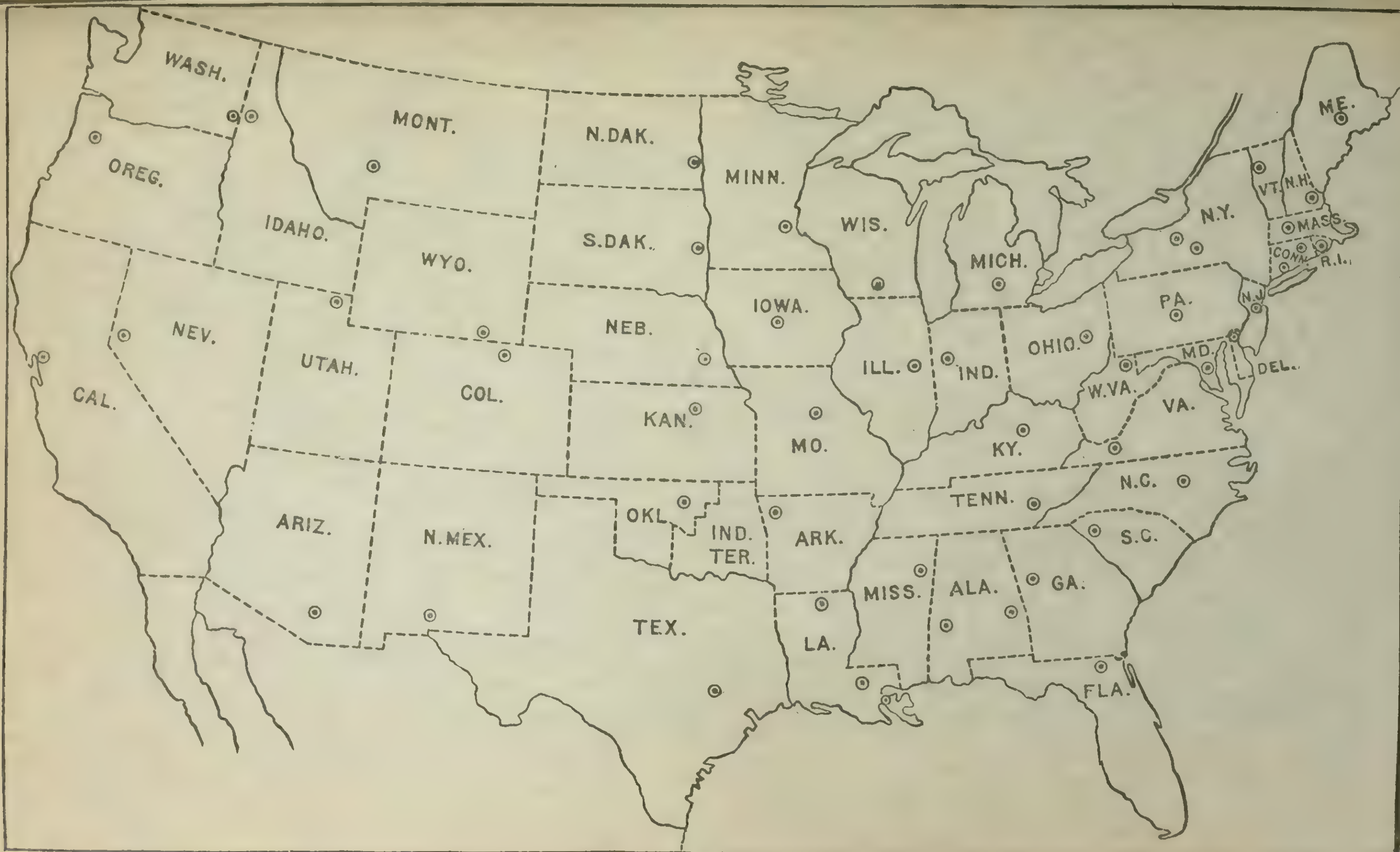
PUBLICATIONS OF THE OFFICE OF EXPERIMENT STATIONS.

Experiment Station Record, Vols. I–IX, with indexes; Vol. X, Nos. 1–4.

Bulletins.—No. 1, Organization and History of the Stations; No. 2, Digest of Annual Reports of the Stations for 1888, in two parts; No. 3, Report of Meeting of Horticulturists, 1889; No. 4, List of Station Horticulturists and Outline of their Work; No. 6, List of Station Botanists and Outline of their Work; No. 8, Lectures on Investigations at Rothamsted Experimental Station; No. 9, The Fermentations of Milk; No. 10, Meteorological Work for Agricultural Institutions; No. 11, A Compilation of Analyses of American Feeding Stuffs; No. 14, Proceedings of Convention of National League for Good Roads, 1893; No. 15, Handbook of Experiment Station Work; No. 17, Suggestions for the Establishment of Food Laboratories; No. 18, Assimilation of Free Atmospheric Nitrogen by White and Black Mustard; No. 21, Methods and Results of Investigations on the Chemistry and Economy of Food; No. 22, Agricultural Investigations at Rothamsted, England; No. 25, Dairy Bacteriology; No. 26, Agricultural Experiment Stations: Their Objects and Work; No. 28, The Chemical Composition of American Food Materials; No. 29, Dietary Studies at the University of Tennessee in 1895; No. 31, Dietary Studies at the University of Missouri in 1895; No. 32, Dietary Studies at Purdue University in 1895; No. 33, The Cotton Plant; No. 34, The Carbohydrates of Wheat, Maize, Flour, and Bread; No. 35, Food and Nutrition Investigations in New Jersey in 1895 and 1896; No. 36, Notes on Irrigation in Connecticut and New Jersey; No. 37, Dietary Studies at the Maine State College in 1895; No. 38, Dietary Studies of the Negro in Alabama, 1895 and 1896; No. 40, Dietary Studies in New Mexico in 1895; No. 42, Cotton Culture in Egypt; No. 43, Losses in Boiling Vegetables, and the Composition and Digestibility of Potatoes and Eggs; No. 44, Investigations on the Metabolism of Nitrogen and Carbon in the Human Organism; No. 45, A Digest of Metabolism Experiments; No. 46, Dietary Studies in New York City in 1895 and 1896; No. 48, A Report to Congress on Agriculture in Alaska; No. 50, A Report on the Work and Expenditures of the Agricultural Experiment Stations, 1897; No. 51, Statistics of the Colleges and Stations, 1897; No. 52, Nutrition Investigations in Pittsburg, Pa., 1894–1896; No. 53, Nutrition Investigations at the University of Tennessee in 1896 and 1897; No. 54, Nutrition Investigations in New Mexico in 1897; No. 55, Dietary Studies in Chicago in 1895 and 1896; Nos. 5, 12, 13, 19, 23, 27, 39, and 47, Organization Lists of Stations and Colleges, 1890, 1892, 1893, 1894, 1895, 1896, 1897, and 1898; Nos. 7, 16, 20, 24, 30, 41, and 49, Proceedings of Association of Colleges and Stations, 1891, 1892, 1893, 1894, 1895, 1896, and 1897.

Farmers' Bulletins.—No. 1, The What and Why of Agricultural Experiment Stations; No. 2, Illustrations of the Work of the Stations; No. 9, Milk Fermentations and their Relation to Dairying; No. 11, The Rape Plant; No. 14, Fertilizers for Cotton; No. 16, Leguminous Plants for Green Manuring and for Feeding; No. 18, Forage Plants for the South; No. 21, Barnyard Manure; No. 22, The Feeding of Farm Animals; No. 23, Foods: Nutritive Value and Cost; No. 25, Peanuts: Culture and Uses; No. 26, Sweet Potatoes: Culture and Uses; No. 29, Souring of Milk and Other Changes in Milk Products; No. 32, Silos and Silage; No. 34, Meats: Composition and Cooking; No. 35, Potato Culture; No. 36, Cotton Seed and its Products; No. 37, Kafir Corn: Characteristics, Culture, and Uses; No. 39, Onion Culture; No. 41, Fowls: Care and Feeding; No. 44, Commercial Fertilizers: Composition and Use; No. 46, Irrigation in Humid Climates; No. 48, The Manuring of Cotton; No. 49, Sheep Feeding; No. 56, Experiment Station Work—I; No. 65, Experiment Station Work—II; No. 69, Experiment Station Work—III; No. 73, Experiment Station Work—IV; No. 74, Milk as Food; No. 76, Tomato Growing; No. 77, The Liming of Soils; No. 78, Experiment Station Work—V; No. 79, Experiment Station Work—VI; No. 81, Corn Culture in the South; No. 84, Experiment Station Work—VII; No. 85, Fish as Food.



The Agricultural Experiment Stations of the United States.